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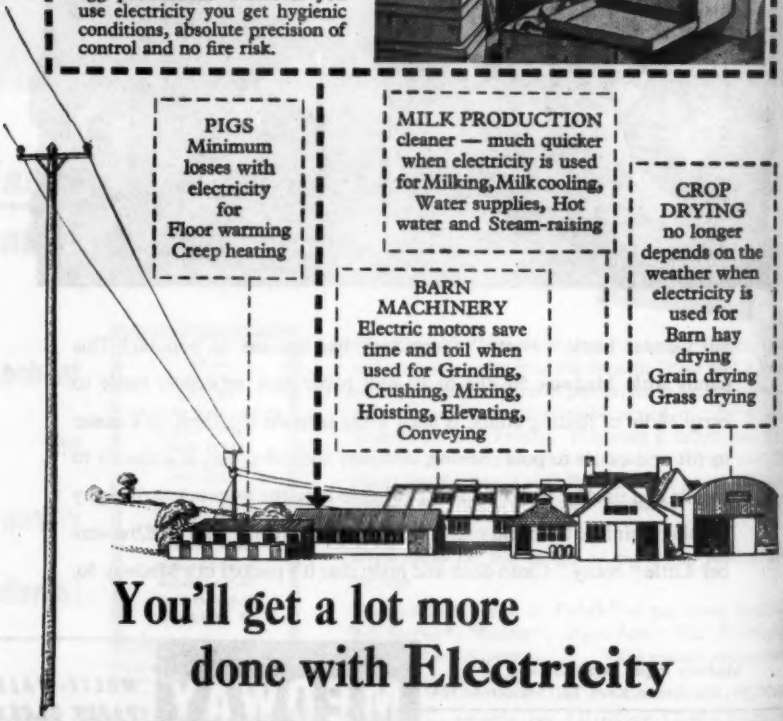

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AGRICULTURE

VOL. LXII No. 10 JANUARY 1956

GOLD IN OUR GRASS

PROFESSOR H. IAN MOORE, M.SC., PH.D., N.D.A., DIP.AGRIC.(Cantab.)

Principal, Seale-Hayne Agricultural College

Good grass, well managed, offers the best means of saving on the stock food bill. We could grow more and utilize it better if we gave more thought to it.

GOOD grass is one of farming's most priceless assets; yet how few, how very few, appreciate the full significance of this vital fact? So few in fact that the Minister of Agriculture at Stafford last October said: "I do not believe we are yet making anything like full use of this priceless advantage. I believe that if we could raise our average performance in the growing and use of grass to the level of the astonishing results being achieved by our most successful farmers—often on not very promising land—we should do more to ensure prosperity and save the need for subsidies, than by any other single development. The scope for progress is surely enormous." How very true!

Those with memories going back to the 1920s will remember the tragic condition of our grassland during the depression and the inspiration of those early war years from 1939 onwards, when ploughs bit deeply into the tough, old, weed-ridden, worthless swards to bring new life and hope to our farms in vigorous, productive leys. And yet, in spite of our experiences and the immense amount of additional knowledge we have acquired both in the art of establishing new grassland and in utilizing the valuable produce, one has only to take a journey through Great Britain at the present time to realize the long road which lies ahead before we can confidently assert that we are using this great asset to the best advantage. During this last summer, I completed a 3,000 mile tour from north to south and from east to west, through farming Britain, through a countryside baked to the colour of the Sahara by a phenomenally dry season. What a contrast with the picture of summer 1954 with its waterlogged land! Yet both seasons, contrasting so sharply in weather conditions, had one factor in common—loss of grass potential.

The Potential that Pays What can grassland do? In his paper to the British Association at Bristol last September,* R. A. Hamilton gave a clear picture of the potential by instancing the case

* Utilization of Grassland. Published in the November and December 1955 issues of AGRICULTURE.

of a small farm of 32 acres, where the output of grass was equal to 42 cwt. of utilized starch equivalent per acre, which, put another way, approximates to a yield of nearly 3 tons of barley per acre. Compare this with the estimated average yield of grass for the whole country of 16.7 cwt. S.E. per acre. Many of our leading grassland farmers are regularly achieving an output of 25-30 cwt. per acre, so the example quoted is not outrageously abnormal.

In a modest way our own experience on the College Farm points to the potential from grassland. The soil is a heavy clay with shale, and its natural fertility is low. Yet with South Devon and Guernsey cows giving high butterfat milk, we secure 3-4 gallons from grass alone from early spring to late summer, and we have fed grass silage alone during the winter to secure a comparable output. It should be borne in mind that these results expressed in terms of other breeds would be appropriately increased. A Guernsey yielding 3 gallons of milk needs approximately the same amount of food nutrients as an Ayrshire yielding 4 gallons, whilst a South Devon at the 3 gallon level is comparable on this basis with a Friesian at 4 gallons.

There is thus no doubt about the value of good grass, but many will follow up the first question with a "does it pay?" attitude. Hamilton supplies the answer in his comprehensive table, showing grass to be the cheapest source of stockfood at £11 per ton of S.E., compared with grass silage and kale at £17, hay at £20, and dairy cake at £54. Today, the plain truth stares us in the face. A farmer with an eye to the most economical production cannot afford but to farm his grassland at the highest possible level of husbandry. This is a sheer economic necessity for both farmer and nation.

The extreme weather contrasts of the 1954 and 1955 grazing seasons have shown up in a striking manner the many and grave weaknesses in our grassland husbandry. The waste of 1954, contrasting with the paucity of 1955, clearly indicates the lack of a definite grassland policy on many farms. Thus more silage made in 1954 from the abundant grass which was surplus to immediate needs would have proved a sheet anchor for the drought of 1955. Nor should the phenomenally fine summer of 1955 have resulted in a wholesale departure from silage to snatch hay crops, for the two are complementary—or should be—and not competitive.

Grow More The problem is obviously twofold—production on the one hand and utilization on the other. Both require a high degree of skill on the part of the farmer, and the evidence indicates that our knowledge and ability to produce good grass outstrips our ability to utilize it to the best advantage when we have produced it. The output from British grassland is seriously below the standard achieved in other European countries, with the exception of France.

Now our grass output depends in the first place—climate and soil apart—upon having the right type of herbage, composed of the highly nutritious productive species, free from competition by weeds. When this is allied to the best possible fertilizer treatment, there is abundant evidence, both from research stations and farm practice, to show how immensely worth while good grassland husbandry can be. An annual dressing of 3-4 cwt. per acre superphosphate and 1-3 cwt. muriate of potash can be regarded as the minimum basic application for most cases. When the land responds to it, slag should be used; on many farms, 6-10 cwt. of high-grade, high soluble slag will bring about a spectacular improvement in the herbage. Periodic liming is, of course, essential, and much of our grassland is still crying out for potash.

Once the basic nutritional requirements of the grass are satisfied, as suggested, nitrogen should be used in generous amounts throughout the season. Although 6 cwt. per acre "Nitro-Chalk", or its equivalent, can be regarded as an annual requirement, as much as 10-15 cwt. per acre will give economic returns on many farms. In the establishment of the ley there is much to commend the practice of giving an application of well-rotted dung to the young seeds immediately after harvest, especially when the plant is weak. The value of this is particularly noticeable in a severe winter and is probably due to the measure of protection given to the young plants by the dung, quite apart from any fertilizing benefit. The additional humus so supplied can be of inestimable value in the following summer during protracted drought. Excellent examples of this were to be seen last summer.

Grass is without doubt the cheapest food for herbivorous stock, and by far the cheapest way of feeding it is for them to help themselves. The desirability for a long grazing season is therefore apparent, and much ingenuity can be brought into play on this problem. The generous use of nitrogen, in conjunction with Italian, H.1, or S.22 ryegrasses, to provide late autumn grazing and a really early spring bite; supplementing grass with kale for autumn grazing; the skilful use of catch crops of rape and ryegrass or rye and ryegrass; and the undersowing of cereal crops with ryegrass to produce stubble grazing—all these will give cheap food for grazing and assist the pastures and meadows.

Utilize it Better How and when to graze are factors of supreme importance in ensuring full utilization of the herbage so produced. The best stage of growth for cattle seems to be about 6-8 inches, bearing in mind the rapid deterioration in protein and the increase in fibre content as grass ages. Ideally, all grass should be presented to the stock at this stage, but the ideal is difficult to attain in practice, and more often than not periods of excessive growth alternate with scarcity. Variation in the seed mixtures and fertilizer treatment will spread-over production to some extent.

Contrary to the views of many, I still favour the Cockle Park type of general-purpose mixture, using a high proportion of the leafy strains of grasses, to supply the main bulk of the season's grazing. This mixture possesses the twin virtues of flexibility and reliability, season in and season out, and does not require the more specialized treatment of the simple single grass/single clover mixtures which are fashionable today. The inclusion of chicory, which is highly palatable and drought-resisting, and 1-2 lb. of rough-stalked meadow grass, which in my experience is supreme as a weed eliminator, is sound practice. Cocksfoot is one of the more unpalatable grasses, yet has value on account of its growth in dry seasons, even in the South-West. Grown in simple mixtures, we found that it was not eaten by stock, whereas when grown in conjunction with ryegrass and timothy, as in a Cockle Park mixture, it was well grazed yet still making a valuable contribution during dry weather. Of the simple mixtures, the timothy-meadow fescue-clover mixture is outstanding by virtue of its palatability. But when all is said, it is very necessary for each farmer to find out from his own experiments on his land which seed mixtures fit in with his farming and suit his needs best.

Nor do I believe it pays to economize in seed. The best weed suppressor is a lusty, well-knit sward. With a thin seeding, many swards have to "fill up"—a pious hope in far too many instances, for the filling is done by weeds and not by productive species. There is abundant evidence to justify a seeding of 30-35 lb. per acre for long leys.

Avoid Dung Spoilage To ensure quick defoliation, heavy stocking is essential, and here the electric fencer is the answer, except on those farms with small, adequately fenced fields or very large herds. The mere use of the electric fencer in fields where extensive grazing has previously been practised will usually increase the stock-carrying capacity by some 20 per cent.

But heavy stocking often gives rise to the problem of dung distribution. An average cow-pat measures 20 × 20 inches, and a cow which dungs when walking forward will foul an area of ground 6 feet × 2 feet. In days gone by (and even today on the Continent) dung was frequently lifted by hand from the best dairying pastures and carted away. To allow it to lie, may not only destroy the herbage underneath, but prevent grazing from an appreciable area surrounding the cause of the taint. An alternative method was to beat out the dung by hand, using a muck fork swung from side to side. Nowadays these methods are usually regarded as impracticable but, if possible, the dung should be allowed to dry partially and then spread by harrowing. An even more efficient method is to run a set of gang mowers over the pasture. These effectively scatter the dung and, at the same time, top the pasture and remove uneaten herbage, thus leaving the field in the required condition to ensure uniform growth for the next grazing or mowing.

The spoiling of grass by dung can be minimized by allowing the cows to graze only long enough to secure their fill and then turning them on to nearby bare land to cud. The cows soon accustom themselves to this procedure. On the College Farm, however, we have found that better and simpler utilization is obtained when mowing alternates with grazing, for this allows the dung to be spread and the herbage kept taint-free before the next grazing. It is also a good plan to run sheep over a field after the cows to glean the pickings, especially if a gang mower is not going to be used. It must be stressed, however, that the efficient and uniform shaving of the herbage by one means or another is of the utmost importance if an even growth is to be secured for subsequent grazings or mowings. In practice, the use of a back fence is often justifiable to secure this level growth, which ensures a product of uniform feeding value.

Manage it Better That precious early bite of spring must always be used with discretion. To turn out dairy cows from winter rations of a non-succulent nature on to the lush herbage of early spring is not only wasteful but may even be dangerous. Grass tetany and other disorders of this nature are often the result of indiscretions in management. Here lies one of the supreme benefits of silage feeding in winter, enabling the animal to be accustomed to ingesting large quantities of succulent food, whereby the change from winter rations to spring grazing is not so violent as otherwise it can be. The provision of hay or straw is always a sound precaution when turning stock out on to lush pasture, not only in the spring but also later in the year, when extreme contrasts in the herbage presented to the animal are unavoidable. It is also important to so ration the succulent foods during the winter that the supply lasts until turning-out time.

Thus whether to graze wholly or mow alternately with grazing is an important decision. Admittedly, good fencing and a water supply in each field are essential for this to be practicable, and by no means all fields are so provided. Money spent in this way, however, is a very sound investment. From careful recordings I have noted the first grazing of the season to be the most efficient: with wise stocking and the electric fence, over 80 per cent utilization can be obtained. As the field has been grazed successively throughout the season, this figure has fallen steadily, until the fourth grazing

has often been no more than 50 per cent efficient, due to the stock refusing to consume tainted herbage. On the other hand, by alternating mowing with grazing—thus largely eliminating taint—the third crop of grass (that is, the second grazing after mowing) has been grazed with 72 per cent utilization. The amount of land made useless by dung is quite staggering, and in a survey carried out this summer pastures grazed more or less continuously throughout the season had over 20 per cent of their surface covered with dung. This land was a complete loss so far as producing grass was concerned. The actual length of time that an undisturbed dung pat remains intact depends upon the rainfall and temperature, and may vary from two weeks to several months; sometimes, as during the past dry summer, rooks will make an excellent job of disintegrating droppings. This dung problem is really serious and one to which attention must be given if full production from a sward is to be obtained; and even with the present high level of wages, some hand-work is often justified, especially on the small, heavily stocked farm. Certainly, efforts to overcome the trouble pay good dividends.

Record Grass Yields But how can one expect grassland output and utilization to be at a high level when so few farmers appreciate, firstly, its potential and, secondly, the output of their own pastures. As in the early days of improved milk production recording was the first step to better herd management, so today grassland recording is a vital need. It is encouraging to learn that at least one Young Farmers' Club has started a grassland recording campaign. Until grassland recording is carried out with the same precision and regularity of milk recording, the vast reserves of productivity that lie in our grass fields will remain untapped.

In the last fifteen years, we have stepped up the level of productivity of our arable land to a point thought to be impracticable at the outbreak of war. Why has this come about? It is because the yields of our arable crops in the main are recorded; because waste is regarded as scandalous; because it is considered sound business, quite apart from sound farming, to fertilize to the hilt; because the securing of a clean seedbed is regarded almost as a point of honour; and because only the best seeds of varieties known to succeed under the specific conditions found are sown.

What a contrast with the cultivation of Britain's alleged premier crop, the poor, often despised, beggarly member of the family—grass! What wasted opportunities! What short-sightedness! What bad business! All the immense resources of our great agricultural societies, the N.A.A.S., the N.F.U. and the Y.F.C. should be pooled in a concerted effort to record grass output on an immense scale, to reward the successes of our best grassland exponents and to secure for grass its rightful place in British agriculture. Surely it is of more importance to farming and to national economy to suitably reward and honour the producer of a first-class ley than he who brings forth a fat beast or a sample of malting barley? For far too long have we taken refuge in the excuse that the adjudication of good grass is extremely difficult and subject to wide errors. Difficult it may be, but how abundantly worth while; for in a very real sense there is gold in our grass.

DRY FEEDING OF CALVES

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In a small-scale experiment at the Rowett Research Institute, calves weaned from milk on to dry meal at 3-4 weeks old made liveweight gains of nearly 1¼ lb. a day.

THE economical rearing of herd replacements is a problem of perennial importance to dairy farmers. Recent surveys carried out by Durham University economists (1) concerning the cost of rearing heifers to first calving therefore merit close scrutiny. The outstanding feature of the data arising from these surveys is the proportion of total rearing costs accounted for by whole milk, milk substitutes and calf meals—foods normally required in the first four months of life. The expense for these items is incurred in less than one-tenth of the time from birth to first calving, yet it represents one-third of the total cost. Clearly, rearing cost in the first months of life is disproportionately high, compared with that for the total growth period. Economy in the early stage could materially reduce the costs of herd replacements.

Unfortunately, the issue has been confused by the controversy regarding the relative importance to the dairy cow of a good start in life. Opinion in this country favours speeding up growth by full feeding during the first six months; but there is little experimental evidence from lactation studies to support the advantages of this system from the long-term view. Scandinavian agriculturists (2) have suggested that low-plane rearing increases longevity and hence lifetime milk production. Filmer (3), in New Zealand, has reported that poorly-reared cattle produced almost as well as their well-reared mates when subsequently fed on a high level of nutrition.

There is a minimum growth rate below which health is endangered, particularly by increased susceptibility to infection, and the onset of first oestrous is unduly prolonged. The point to be stressed is that the poorly-reared, pot-bellied calf may have an equal chance, subject to its genetic merit, of producing as much milk as its sleek and expensively reared counterpart. Calf flesh does not necessarily guarantee future milk but it certainly increases the overheads of the dairy industry.

Liquid or Solid Foods? Most dairy farmers would agree that economy in calf-rearing is most readily secured by the use of milk substitutes. Yet, as American workers (4) have pointed out, such practice is not necessarily the final answer to the problem of economic rearing; for milk substitutes are almost always based on dried milk products, the price of which is generally tied to that of liquid milk.

Suckling is the only mechanism by which mammals can provide food for their young, but that is no reason why the technique should be emulated by the rearer. The popularity of gruel as a milk substitute is a result of the belief that the calf requires a liquid diet. On the contrary, liquid feeding delays development by stimulating the operation of the oesophageal groove, which allows food to by-pass the rumen.

A more rational approach to the problem of economic rearing is to induce adult-type rumen function at an early age, so that the calf may be fed entirely on roughage and simple grain mixtures (based on vegetable protein)

from the third or fourth week. The aim of this method is not to replace whole milk but to develop the digestive system of the calf so that it can deal with solid foods (for example, meals).

Although it has been accepted that digestion in the young ruminant is analagous to that in the simple-stomached animal, and that rumen function is initiated by the ingestion of roughage, it has generally been assumed that from the practical feeding standpoint this took time, even though rumen movements are apparent in the one-week-old calf (5). Recent (unpublished) work by my colleagues and I has shown that three-weeks-old calves can digest the dry matter of grass as efficiently as the adult ruminant, and that this efficiency was reached within two days of grass being ingested. Thus it would appear that the development of adult-type rumen function in the calf is governed not so much by age as by the rate at which the calf learns to eat solid food. This hypothesis forms the basis of a method of rearing calves which is being investigated at the Rowett Institute.

Weaning at Three Weeks Old A preliminary experiment was begun in May 1955, and was designed primarily to find out whether calves could be weaned successfully at three weeks old. Two methods of weaning—abrupt and gradual—were investigated. Six Ayrshire male calves were collected from farms within four days of birth, and were tied in individual stalls on slatted floors. Water was available from the beginning of the experiment. The calves were allocated to two groups: Group A, the abrupt weaning group, received 6 lb. whole milk daily from 4 to 24 days old; Group B was weaned gradually, 6 lb. whole milk being fed daily from 4 to 10 days old, 5 lb. daily from 11 to 17 days, 4 lb. daily from 18 to 24 days, and 3 lb. daily from 25 to 31 days. Thus both groups were fed the same quantity of milk—but over different lengths of time. The daily milk allowance was divided equally between two feeds.

On the tenth day both groups were offered a meal mixture comprising:

	per cent
Flaked maize	50
Crushed oats	19
Fishmeal	10
Linseed cake meal	10
Dried skim milk	10
Vitamins A and D	1

plus 5 lb. proprietary aureomycin supplement to every ton of mixture.

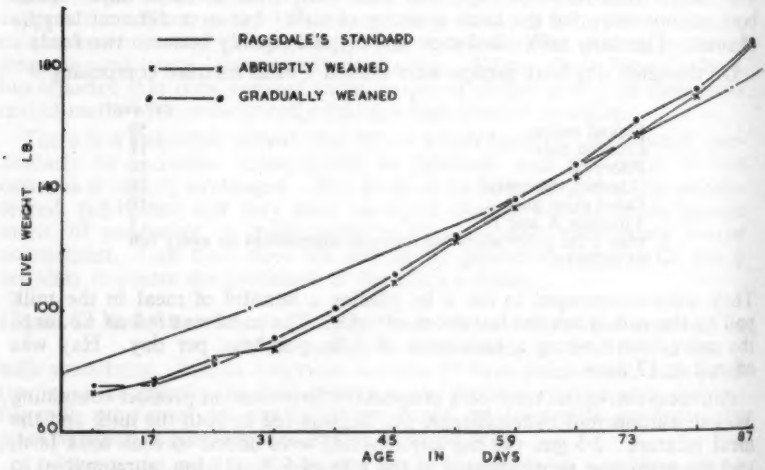
They were encouraged to eat it by placing a handful of meal in the milk pail as the calf drank the last drops of milk. The meal was fed *ad lib.* until the calves were eating a maximum of 4 lb. per head per day. Hay was offered at 17 days.

Aureomycin, in the form of a proprietary fermentation product containing 3·6 gm. aureomycin hydrochloride per lb., was fed in both the milk and the meal mixture: 2·5 gm. (40 mg aureomycin) were added to each milk feed, and the meal was supplemented at the rate of 5 lb. (18 gm. aureomycin) to every ton of mixture. Live weights and skeletal measurements were taken weekly; meal consumptions were recorded daily. For estimations of feeding costs, milk was charged at the prevailing pool price and concentrates and hay at purchase price.

Liveweight gains, feed intakes and feeding costs for the period from 4 to 87 days are presented in the table on the next page. Growth curves are compared with Ragsdale's standard (8) for normal growth of Ayrshire calves in the figure.

Growth, Feed Intake and Feeding Costs of Ayrshire Calves from 4 to 87 Days

	Mean Value for Abruptly-weaned Group	Mean Value for Gradually-weaned Group	Mean Value for all Calves
Daily liveweight gain, 10-31 days (*lb./day*)	0.68	0.72	0.70
Daily liveweight gain, 32-87 days (*lb./day*)	1.59	1.55	1.57
Daily liveweight gain, 10-87 days (*lb./day*)	1.48	1.46	1.47
Increase in height at withers (*in.*)	4.2	5.0	4.6
Age at weaning (*days*)	24	31	27.5
Milk consumption (*lb.*)	126	126	126
Meal consumption, 10-87 days (*lb.*)	204	190	197
Hay consumption, 17-87 days (*lb.*)	46	50	48
	£ s. d.	£ s. d.	£ s. d.
Feeding cost, 4-87 days — Milk	1 9 3	1 9 3	
Meal	3 13 4	3 8 4	
Hay	3 4	3 6	
Total	5 5 11	5 1 1	5 3 6
Feeding cost per lb. liveweight gain (*pence*)	11	11	11



Growth curves of early-weaned calves, compared with Ragsdale's standard for normal growth

No Check in Growth or Health The surprising features of the results of this preliminary experiment are the high mean rate of liveweight gain and the absence of any marked check to growth at weaning. Low feeding costs were planned; the excellent growth response was not expected. The calves were normal in appearance and well fleshed.

A liveweight gain of 1.47 lb. per day and an increase in wither height of 0.060 inches per day compares favourably with the accepted standards for normal growth of Ayrshire male calves of 1.10 lb. and 0.057 inches per day, respectively (⁶). Little significance, however, can be attached to data for wither height in view of the considerable error associated with the taking of this measurement.

The total liveweight gain from 10 to 87 days was not affected by the method of weaning. Over the milk feeding period the abruptly-weaned calves gained more weight than their gradually-weaned counterparts, but this advantage was offset by a slight check at weaning, which the gradually-weaned calves did not suffer. A compromise between the two methods is indicated.

Slatted floors were used in this experiment, as it was decided that the calves should not have access to litter during the early stages of meal feeding. However, more recent trials have demonstrated that sawdust is equally satisfactory. Straw could be introduced when the calf is weaned, but to use it earlier might involve an extended milk feeding period.

Little hay was eaten until the ninth or tenth week, when the calves were consuming the maximum allowance of concentrates. The appetite for roughage varied markedly; one calf ate only 15 lb. hay throughout the experiment, whilst another ate 80 lb. There was no apparent relationship between growth performance and ratios of hay to meal selected by the respective calves.

The introduction of a high energy meal mixture into the diet of the calf at such an early age did not result in any digestive disturbances. Aureomycin may have been responsible for this well being. There is at present considerable evidence that feeding aureomycin to calves for the first 12 weeks of life increases liveweight gains, feed intake and feed utilization efficiency. A decreased incidence of scours is also reported (⁷). The reason for these effects is less easily established. Control of secondary infections, elimination of micro-organisms which compete with the host for essential nutrients, stimulation of other micro-organisms which synthesize B-complex vitamins—all these reasons have been advanced in partial or total explanation of the action of antibiotics.

A good appetite is essential for calves reared on an early weaning system, the success of which depends on the readiness with which they begin to eat dry meal. Freedom from scours and digestive upsets is important in any rearing system but doubly so when only a small quantity of whole milk is fed. Thus the feeding of antibiotics may be an integral part of any early weaning system. Clearly this aspect requires clarification.

Encouraging Results A cost of only £5 4*s*. to feed a calf to 12 weeks of age is very satisfactory: a conventional method involving the feeding of 40 gallons of whole milk would entail spending £4 10*s*. on the milk alone. An additional item in favour of early weaning, compared with late weaning systems, is its saving in labour. Moreover, calves may be grouped in larger units at an earlier age.

No conclusions can be drawn at this stage as to the efficacy of early weaning for reducing rearing costs. It must, in fact, be emphasized that these results are based on one experiment with six calves. Further experiments are in progress to confirm these initial findings and, if possible, to reduce costs still further by the use of less whole milk and simpler and cheaper meal mixtures. It is not intended that recommendations for farming practice should be made until the method has been more thoroughly

investigated. Suffice it to say that these preliminary findings are encouraging, and it is because very considerable interest has been shown in these experiments that this present report is made.

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AGRICULTURAL STATISTICS: ENGLAND AND WALES

GLASSHOUSES (*a*) (July 1955)

	July 1954 (b)	July 1955 (b)
TOTAL AREA OF GLASSHOUSES	*acres*	*acres*
With heating apparatus	3,906	3,851
Without heating apparatus	756	763
TOTAL	**4,662**	**4,614**
CROPS IN GLASSHOUSES AT JULY		
Tomatoes		
Grown in glasshouses fitted with heating apparatus	3,092	2,431
Grown in glasshouses not fitted with heating apparatus		569
Cucumbers	480	455
Other vegetables and herbs	33	28
Grapes	32	28
Peaches and nectarines	18	17
Other fruits	5	4
Carnations	182	191
Roses	108	115
Orchids	10	10
All other flower and foliage crops	344	366
All other crops not specified above	67	76
Remaining glasshouse area (being the area unused at census date, or used for purposes not shown above)	291	324
TOTAL	**4,662**	**4,614**

(*a*) Including Dutch light structures which were glazed at the census date.

(*b*) The figures for July 1954 are in respect of holdings which had not less than 1,000 square feet of glass, *including* lights and/or cloches. The figures for 1955 are in respect of holdings which had not less than 1,000 square feet of glass *excluding* lights and/or cloches.

THE MERIT OF LUCERNE

NORTHAMPTONSHIRE EXPERIENCE

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Given a fertile, well-drained soil and reasonable management, lucerne will provide a useful bulk of high quality herbage in the driest and hottest weather. Northamptonshire experience last summer emphasizes its value in the farm feeding programme.

FOLLOWING a succession of wet summers, which gave an abundance of grass on nearly every farm, last year's hot, dry weather provided a sharp reminder of the bare pastures and falling milk yields which drought periods can bring. Many farmers had to start feeding hay during August so as to maintain milk yields and the condition of their cattle. It is in such years that lucerne really comes into its own and its value as a drought-resisting crop is fully appreciated. Farmers with an acreage down to lucerne last year were really "in clover". In Northamptonshire it was the first true lucerne year since any appreciable acreage had been grown in the county. This is not to imply that lucerne has a value only in dry summers; it is a useful crop in any year and now constitutes part of the basic herbage acreage on many farms. But experienced growers report that it invariably grows more strongly in periods of hot, dry weather.

What are the merits of lucerne? It is one of the earliest of plants to make growth in the spring for early strip grazing and is ready to cut early for silage or hay. It quickly recovers after cutting or grazing, and 3-4 cuts, or both cuttings and grazing, can be taken in a season. Up to 4 tons of dry matter per acre can be expected from a well-managed crop. It will grow well in the hottest and driest of weather. It provides valuable winter keep, either as a straight crop or sown with a companion grass, and will withstand considerable poaching during the winter months. By virtue of its strong, deep-rooting system and nitrogen-fixing nodules, it is a great fertility builder and soil improver.

Because it is so productive and adaptable, lucerne is naturally rather exacting in its fertility and management requirements. However, it has been found to give quite useful yields even when abused, and although such management will affect its persistency, all manner of liberties can be taken with an established stand, particularly in the year before breaking up. Properly grown and managed, it has a life of four to six years under local conditions, but with careful nursing it will go on much longer.

Requirements for Success The basic requirements for good lucerne are simply explained. In rotational farming it demands a reasonably high level of fertility and generous feeding, although quite strangely (and so far inexplicably) it has proved to be a most successful pioneer crop on the sticky, infertile soils of restored ironstone workings. It will grow successfully on most of the soil types found in Northamptonshire, from the light sands to boulder and lias clays (although it does better on the lighter, drier soils), provided a few points are observed. For example, both surface and subsoil drainage must be efficient. Deeper ploughing and/or subsoiling will break the plough pan and improve drainage sufficiently to

make the difference between success and failure on much of the medium and heavy land. The roots of lucerne can themselves lead indirectly to drainage difficulties. Whereas they will open up the subsoil to considerable depths, the lateral and main roots are also likely to penetrate the joints between land tiles in their search for moisture and can, in a very short time, completely block the drains. On one field which was tile-drained six years ago before sowing to lucerne, most of the drains were found to be choked with a tight, solid rope of roots when recently they were re-opened. The answer to this would appear to be porous socketed pipes.

The strains of lucerne at present available in Britain are highly sensitive to lime and fertilizer deficiencies, and whenever there is any doubt a soil analysis should be arranged well ahead of sowing. A *p*H of 6.8 to 7 should be aimed at; if the figure is much below this, liming will be necessary. If the lime requirement is in the region of 3-5 tons or so of ground limestone per acre, as in many fields in this county, lucerne is "out" for at least a year. In such a case the field should be well cultivated slightly deeper than the previous plough depth, the required quantity of lime applied during the cultivations, and an alternative crop taken before lucerne. For this purpose, a root crop, preferably for grazing, is better than a cereal crop. Where the lime requirement is very high, a further 20-30 cwt. ground limestone per acre should be given to the lucerne seedbed in addition to the initial heavy liming for the preceding crop.

Both potash and phosphates are essential for lucerne, but there have been more failures due to lack of potash than to lack of phosphate. On fields with an acute deficiency of either or both, one year of building up, followed by a dressing on the seedbed as for liming, has given better results than heavy initial dressings applied for an immediate sowing of lucerne. A small dressing of nitrogen on the seedbed helps establishment and growth in the early stages. Some good results have been obtained by combine drilling the seed and fertilizers, but there is a considerable risk of damage to the seedlings if conditions are unfavourable to quick germination. Sowing the fertilizers before drilling is a safer practice.

Although, given satisfactory soil fertility and good plant establishment, lucerne will tolerate competition from annual weeds, the timely spraying of these weeds with a dinoseb compound, or early topping with a machine, will encourage and strengthen the establishment of the lucerne. Creeping perennial weeds and indigenous grasses and clovers have been noted as having a markedly suppressing effect, and in a number of instances have been a contributory cause of failure. Lucerne should not, therefore, be sown too soon after old grass or a long ley, or on land infested with twitch, water-grass or creeping buttercup.

Straight or in Mixture? A mixture of lucerne and one or more of the leafy grasses is favoured by many growers on account of the increased bulk obtained, but the inclusion of grasses increases the management problems, makes the stand less adaptable, and, in many instances, has adversely affected the persistence of the lucerne, particularly in wet summers. The inclusion of grasses does, however, make for better drying during haymaking and helps fermentation during silage-making. The suggested sowing rate per acre is 14-16 lb. lucerne, either sown straight or with the addition of 3 lb. S.37 cocksfoot, 3 lb. S.48 timothy, or 4 lb. S.215 meadow fescue. Alternatively, a mixture of 6 lb. lucerne and 4 lb. meadow fescue (or 3 lb. cocksfoot) can be sown in alternate drills.

The lucerne/meadow fescue mixture is proving highly successful and would appear to be ideal under local conditions. Sowing in alternate drills

(designed primarily for winter stocking), which gave extraordinarily good results on the heavy clays at the former British Grassland Station at Drayton in Warwickshire, has so far not been very encouraging in this area. Summer production has been very disappointing, and it seems that although beef breeds and their crosses will thrive when winter grazing lucerne in extreme cold and wet, the physical discomfort of such conditions is more than some of the pure dairy breeds can endure. On one farm last winter a bunch of Friesian bulling heifers lost condition very rapidly whilst grazing a strong lucerne/grass ley.

Of the many French and Canadian types of lucerne grown in this county, Du Puits, Ile de France and Provence are the most popular. Du Puits costs more in most seasons than the others, but it is very well suited to local conditions and, in almost all cases, has been more productive, leafier and more persistent.

Sowing and Management We have had the best results in Northamptonshire by drilling lucerne on a well-prepared seedbed without a cover crop. The problem of annual weeds associated with direct sowings can be overcome if soil fertility is adequate and the seedbed satisfactory; if they are not, lucerne is likely to fail anyway, whether it is sown with or without a cover crop. Where undersowing is preferred, it should be under a spring cereal crop, and spring wheat in this county has been most satisfactory, particularly where the seed rate of the cereal crop has been reduced to 1-1½ bushels per acre. Good results have been obtained from sowings made any time between mid-April and early August (except in extreme drought); earlier or later sowings are not recommended. One-way drilling will give adequate plant establishment and ground coverage. Inoculation of the seed is essential for all sowings on land that has not recently been cropped with lucerne.

In some instances the Pea and Bean weevil has caused severe damage in the early stages of establishment, resulting occasionally in complete loss. Dusting or spraying with DDT or some other insecticide has given very effective control.

On most soils vigour can be maintained in the lucerne ley by a generous annual dressing of potash and some phosphate. An occasional dressing of well-rotted farmyard manure also helps. Whichever system of summer management is adopted, the fields should be rested from mid-September to early November to build up food reserves in the root. This rest period can be followed by grazing and winter stocking, which helps to check the grasses and consolidates and increases the vigour of the lucerne crowns. The vigour and strength of the plant can also be encouraged by allowing it to run up to the early-flowering stage once during the summer period, and with new stands this growing up should, if possible, be allowed for the first spring growth.

Between February and early March established fields should receive a thorough cultivation in the form of heavy harrowing, pitch-pole harrowing or light cultivator to split the crowns, break up the surface soil and check the grasses. This is a convenient stage for the application of fertilizers. A periodical check on the lime status is advisable, particularly on lighter land that was initially in need of liming.

Nitrogen top dressings are not recommended for established stands. They will encourage the growth of sown and weed grasses, and may give slightly higher bulk yields, but the lucerne will be checked severely by the resulting increased competition. When the aim is to provide winter keep from lucerne

and grass sown in alternate drills, a liberal dressing of nitrogen applied in the late summer is, however, desirable to increase the yield and feeding value of the winter grazing.

Careful Conservation Efficient utilization is probably the most difficult aspect of lucerne-growing, and it involves considerable planning if the maximum potential output is to be obtained. The sequence of cuts must be well timed (that is, at the stage of maximum leafiness before the stems become hard), and adequate provision must be made for conservation. Orthodox haymaking methods will not normally suffice for lucerne if high quality is desired, and the farmer must be ready to dry, make silage or use tripods in most seasons.

As an indication of the loss of leaf that can occur in handling, I know of one case in which lucerne came off the drier with an analysis of 20.5 per cent crude protein; yet another sample taken from the same consignment of dry material after baling, carting and stacking, gave a crude protein of only 9 per cent. This suggests that to overcome such losses, dried lucerne should either be ground and stored in paper bags or should be cubed straight from the drier.

The making of good, palatable silage from very young lucerne is difficult and tedious. The young material is very leafy and succulent, and packs tightly in a pit or clamp. This results in the rapid exclusion of air, reducing fermentation and frequently giving rise to underheated, foul-smelling silage. These snags may be overcome to some extent by not ensiling in very wet weather, using liberal quantities of molasses, avoiding over-consolidation and keeping a careful and regular check on temperatures. Well-made lucerne silage is an excellent feed, and samples from the county have shown up to 26 per cent crude protein.

During an average Northamptonshire summer the tripod is essential for making first-class lucerne hay, for if the crop is turned frequently or spends a long time in the swath, most of the leaf and feeding value will be lost and the resultant hay will be stemmy and brittle. But in a season such as 1955 the second or third crop can sometimes be harvested successfully by pick-up baler. One sample, which was baled a few days after cutting, was gathered full of leaf and colour and had a protein content of 19.1 per cent. On fields that cannot be grazed the lucerne can be cut and fed green to cattle on pasture (soilage), and at least one large dairy farmer not too well off for labour depended very largely on this practice for his summer milk last year.

Summer grazing must be controlled, and electric fences are extremely efficient for this purpose. The aim should be to graze off quickly in small plots during the period of maximum leafage under a system of alternate grazing and resting, topping off after each grazing. As mentioned earlier, lucerne recovers and grows again quite quickly after cutting or grazing, but continuous or too early grazing of the young new shoots will weaken the plant. It will thrive under conditions of heavy grazing for short periods between rests but will not tolerate continuous grazing, however light.

INTENSIVE FARMING ON A SMALL SCALE

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Specialization is not the only way of providing a reasonable standard of living on the small farm. A well-integrated system of arable and grassland, with a variety of livestock projects, can be just as profitable, as this account of a 54-acre holding near Peterborough clearly shows.

HOWE Farm, Glinton, near Peterborough, was started by Mr. W. H. Robinson in 1946 as a block of 24 acres of worn-out, poorly-drained arable land, with no buildings except a semi-derelict cattle yard and shelter. Capital was limited, as it is on most small farms at the outset, and, although this is not intended as a success story, it is only fair to mention that Mr. Robinson faced as many difficulties as most new farmers on a small acreage. He was fortunate in being able to take over another 30 acres of adjoining land in 1949, but the successful development of the whole enterprise is due entirely to the application of the same principles and techniques that he adopted right from the beginning and, above all, to the attention given to detail.

The soil is a naturally alkaline marine gravel, deficient in potash, but not badly supplied with phosphate. On this type of land, the term "worn-out arable" reflects a low level of organic matter with associated loss of soil structure, so that in addition to a generous use of suitable fertilizers, a ley system was desirable, accompanied by heavy stocking. The worst 11 acres were sown to a Cockle Park mixture, and later another 3 acres were put under lucerne and cocksfoot—the latter being intended primarily for hay. Sugar beet, kale and mangolds were chosen as the root crops, wheat as a cash crop, and feeding barley for home consumption.

The Cockle Park mixture served its purpose for the first few years, but an extension of the grazing season was essential for full stocking. Changes were therefore soon made, and today four different mixtures in 3-acre blocks permit rotational grazing for nine months of the year, with sugar beet tops and hay feed as supplements during the autumn and early winter. The mixtures used are: perennial ryegrass (S.23) – white clover (S.100); the original Cockle Park mixture; cocksfoot (S.143) – timothy (S.48) – meadow fescue (S. 215 and S. 53) – white clover (S.100); lucerne (Provence) – cocksfoot (S.143).

The three grass mixtures come into production in the order set out above, with the third mixture providing most of the summer grazing; the lucerne is cut three times for hay and grazed only in late autumn and winter. There is also an off-lying field of 2½ acres sown to the mixture of cocksfoot, timothy, meadow fescue and white clover, to provide hay and some extra grazing. All the grass mixtures receive 4-5 cwt. complete compound fertilizer in September, and 4-6 cwt. "Nitro-Chalk" during the grazing season. The lucerne, too, shows a valuable response to nitrogen in April, and the hay, which is baled from tripods, is of a consistently high quality. Last year, despite the drought, 17 cross-bred steers (now 20-22 months old) were reared and partly fattened without supplementary feeding on 8½ acres of grazing between April and late September.

Fattening off Grass Hereford and Aberdeen-Angus cross-bred calves are bought every autumn at 4-6 months old, the Hereford on Aberdeen-Angus cross being preferred because it generally puts on weight quickly. Very great importance is attached to the selection of these calves, since they must not only be well reared and of good conformation, but also available at a sensible price. Calves reared by single suckling are always chosen, and for the first winter they are kept in yards on a moderate-high plane of nutrition. At that age the quantity of food needed is not very great but the quality is important. First-class hay is always available, plus a home-mixed ration of oats, beans, bran, sugar beet pulp, high protein meal and minerals. From 12 months old, when their appetites are a consideration and they are growing quickly and putting on weight, they live entirely on grass, reaching about 9-10 cwt. by 18 months of age. Foggage grazing and sugar beet tops with a little hay keep them gaining in weight until Christmas, when they are again brought into yards for a final three months of fattening on a high plane of nutrition, ready for slaughter at 2 years old, weighing 11-13 cwt. It is only the last months of yard feeding that are expensive, and every effort is made to reduce this cost without lowering the standard of feeding. Mixing and grinding meals at home save a good deal, and recently mangolds have been replaced by silage made from purchased pea haulm. If this proves satisfactory, it will reduce the cost and release the mangold acreage for more profitable crops.

The following costings for a group of six cattle graded in 1953 are a fair indication of the value of this enterprise, and when related to the 14 acres of land on the holding devoted to a yearly output of 16 fat cattle, the standard of production is remarkably high.

Costings for Beef Cattle, 1952-53

Opening Valuation										£	s. d.
6 Steers—8 months old at £32 each										192	0 0
Direct Costs—Summer						£	s.	d.	£	s. d.	
Grazing						29	18	6			
Shepherding (44 hours)						5	17	4			
Tractor (44 hours)						13	7	8	49	3 6	
										49	3 6
Direct Costs—Winter											
Food				*tons*	*cwt.*	*qr.*	£	s.	d.		
Hay				6	5	0	31	5	0		
Mangolds				5	8	0	10	16	0		
Silage				6	18	0	13	16	0		
Fodder beet				1	11	2	5	3	5		
Sugar beet pulp ...				2	4	3	39	3	2		
Oats					11	1	8	8	9		
Beans					11	1	15	3	9		
										123 16 1	
Labour											
Men (328 hours)							43	14	8		
Tractor (51 hours)							15	10	3		
Miscellaneous (carriage)							1	10	0	60 14 11	
											184 11 0
Total direct costs											233 14 6
Closing Valuation											
6 Steers—total weight 70 cwt. 1 qr.											542 16 3
Grading Results 3—SS. 3—S.											
Difference between opening and closing valuations											350 16 3
Total direct costs											233 14 6
Surplus on 6 steers											117 1 9

Pigs for the Pork Market Large White × Essex Saddleback were chosen in 1946 for the pig enterprise. In addition to rearing for bacon, there proved to be a good market for litters at weaning age. But with the increasing emphasis on quality, a change to Large White and Landrace has taken place, and the herd is now quickly being dominated by the Landrace type. Mr. Robinson sees many of the carcasses and has found the Landrace consistently giving a few more pounds of the better quality joints—a factor that pleases the butchers and helps to ensure a good market. His present aim is to produce 200 first-class pork pigs a year, and judging by the carcass exhibited at a recent demonstration on the farm there can be no doubts about his ability to produce the quality.

The conversion rate is not studied continuously, but records have been kept from time to time and the figure has always proved satisfactory. That reflects on both feeding and housing and, to some degree, on management. Feeding, which is always the biggest item of cost in fattening pigs, is given the closest attention. Home-mixed rations are only a saving if they are accurately prepared *all* the time, and an effort has been made to evolve a reliable system to ensure a consistent product. All the barley grown on the farm is used for feeding and the other ingredients are bought separately. How much the home grinding and mixing saves is difficult to calculate, but about £6 per ton would seem to be a fair figure. With the pigs consuming something in the region of 50 tons of meal per year on their own, there is obviously a considerable saving.

Housing is not elaborate and, in theory, the design of the sties is open to criticism, but the fact remains that even in bad weather the pigs thrive and appear quite comfortable. Probably this is due to the southern aspect of the sties, which have the cattle yards on the north side to break the winds. Infra-red lamps for the young pigs and creep feeding help to ensure a good start, and at present dry feeding is practised up to about 12 weeks. The aim is a porker of 150 lb. live weight at 18-20 weeks old, and the weighing machine is well to the fore in achieving this end.

Poultry for Eggs and Table Winter egg production has been simplified by the erection of a new deep-litter house designed to hold 450-500 laying birds. The walls are of concrete blocks, and the roof of corrugated asbestos cement sheets is lined with painted fibre board—the space between roof and lining being insulated with fibre glass. Ventilating shafts are fitted with electric extraction fans, and the windows can be removed to allow more air in the summer. Electric light is fitted to increase production in winter, and the water supply is automatic. The original floor of rammed earth was found to be unsatisfactory because it allowed moisture to rise, so a concrete floor has now been laid, and this is proving satisfactory.

Turkeys, at first a sideline, are now an important feature. About 250 turkey poults are bought in mid-August and housed in wooden verandahs having slatted floors raised well off the ground. They are a broad-breasted type which put on flesh rapidly, the hens reaching 10-13 lb. and the stags 16-20 lb. by mid-December. Kale is grown specially for these birds and they eat a considerable quantity of it, in addition to wet mash. A root pulper and shredder for kale and a 1 cwt. wet-mash mixer are invaluable.

To make use of grain which would otherwise be wasted, 150 caponized cockerels are bought in August and run on the stubbles until mid-November, when 3-4 weeks of good feeding gets them ready for the Christmas trade. Caponization results in a large bird carrying a heavy weight of flesh, which

satisfies the special seasonal demand, and this enterprise has the double advantage of low cost and an assured market.

Although the livestock tend to steal the picture, the arable crops have not been neglected. Yields have been stepped up by liberal manuring, and the large head of stock has made it possible to improve the level of organic matter in the soil. The value to the livestock of such products as sugar beet tops and cereal straw is fairly obvious, but not so widely accepted is the choice of a feeding variety of barley. Herta, the variety in use at present, gives a naturally higher yield than most malting varieties, and because malting quality is not required, extra nitrogen can be given to increase the yield and protein content.

Keeping Down Costs Too much capital invested in machinery and fixed equipment means a large annual charge for depreciation and interest, yet it is extremely difficult on a small acreage to keep these items within bounds. Machinery is often the biggest difficulty, and the solution is either to employ a contractor or to hire out the farm machinery on a contract basis to neighbours. A combination of both methods is adopted at Howe Farm. All the ploughing is done by a contractor and other machines are hired when needed. A tractor and trailer and a mounted mower are considered essential permanent equipment. Combining and bailing are carried out by a happy system of co-operation with a neighbour, whereby machinery and labour work on both farms, in each case with an appropriate hire charge. It extends the acreage covered by the machinery, and the labour available is more efficiently deployed.

All the other equipment on the farm is electrically driven. Apart from the hammer mill, root pulper and mash mixer already mentioned, it includes a 10 cwt. meal mixer and a plucking machine for the table poultry. The livestock projects are large enough to justify these machines and to carry the overhead costs.

The large number of new buildings could have added an excessive burden of overhead charges, but almost the whole range has been erected by direct labour, with a considerable saving in initial cost. The pigsties, cattle yard, deep-litter house, and even the farmhouse, have all been built in this way. It involved more work and organization than the contract system, because the materials had to be bought and skilled men employed. A certain amount of building work has also had to be done by the farm labour force. But the result is a range of buildings which have been built to a higher standard than the farm could have afforded on the more usual contract basis.

An intensive system of farming needs intelligent labour, and Mr. Robinson has found that a man who will take an interest in the farm, learn the system and help to make it pay, is worth not only a good wage but attractive conditions of employment as well. In line with many industrial undertakings, he has adopted the idea of a pension scheme by taking out a life assurance policy for the man who has been working for him since leaving school in 1948. It is an encouraging step towards the development of agriculture as a more worthy competitor on the labour market, and a sign that efficient farming can offer a worthwhile career to intelligent men.

THE CHOICE OF CEREAL VARIETIES IN CAMBRIDGESHIRE

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Are you growing the best varieties of wheat, barley or oats in terms of farm profit? The survey just carried out in Cambridgeshire, which arose from a suggestion of the county's Technical Organization Committee, gives some interesting food for thought.

CORN is the most important product of Cambridgeshire farms. The recent cereal harvest was probably worth nearly £5 million, which is over two-thirds of the value of the year's arable production. Costs of corn production vary relatively little between farms, and the profit depends largely on the yield obtained. High yield on any particular farm is governed by three main factors—variety, manuring and disease. To get more precise knowledge than was otherwise available on the choice of varieties being grown, we wrote to every farmer of more than 50 acres (over 90 per cent of the county's farming area), asking for information on the acreages and varieties of cereals being grown. The very good response has given us figures for about two-thirds of the cereal acreage in the county.

In general, farmers have chosen their varieties wisely, for on about three-quarters of the corn acreage varieties have been grown that will give yields at or near the maximum. On the other hand, some are growing low-yielding varieties which have long been outmoded.

There is a wide variety of soils in Cambridgeshire—from heavy clay to light chalk, from heavy brown peat to light blowaway fen—and naturally the survey showed that soil type had some influence on the choice of variety, although not perhaps so great as might be supposed. The best yielder on one soil is in our experience usually a good yielder on all other soils in the same area, although some fen areas have rather special needs.

It has long been said that the number of varieties commonly grown in Britain is far too great. In Cambridgeshire we have found 38 varieties of winter wheat, 17 of spring wheat, and a similar number of both barley and spring oats. Some of these are recent introductions being grown mainly for seed, but many could be dropped with financial advantage. Another thing is the number of varieties of any one cereal being grown on individual farms.

Winter Wheat Table 1 shows the winter wheat varieties sown before January 1, which we chose as the dividing line between autumn and spring drilling. Cappelle Desprez is the heaviest yielder under most conditions in Cambridgeshire and rightly occupies first place. Hybrid 46 is especially suitable for fen soils, and the fact that it occupies second place is due mainly to its popularity in the fens. For upland conditions on clay and chalk soils, Hybrid 46 is inferior to Cappelle, due partly perhaps to its greater susceptibility to Eyespot and thus lower yields.

Eclipse in third place is surprising, since yield trials a few years ago showed it to be markedly inferior to Cappelle. More recently the results from Eclipse have been rather variable, but they have never been good

enough to justify its present popularity on the basis of yield alone. Perhaps, with the disappearance of our old red-chaffed wheat varieties, there is a special liking for the attractive appearance of a field of Eclipse. This variety is noticeably more popular on the chalk, and much less common on the clays.

Minister is of special interest, as it is the only variety at present challenging Cappelle for yield supremacy. It has been grown only for two years on a large scale in Cambridgeshire, and at 9 per cent of the acreage appears to be making a permanent place for itself, despite the marked tendency for its white grain to sprout at harvest. The section of the milling trade making biscuit flour seems to find Minister most attractive.

Minister and Cappelle are at present the most profitable wheats for most conditions in the Cambridge area. Is it significant that these are the only two varieties grown in this country which can yield well in the presence of Eyespot? The only Eyespot-susceptible variety seriously challenging these two is Hybrid 46, and this only in the fens where the disease is rarely a problem.

Table 1

Winter Wheat

Varieties in Order of Popularity	Percentage Grown in Whole County	Varieties in Order of Popularity	Percentage grown in Whole County
1. Cappelle Desprez	30	7. Bersée	3
2. Hybrid 46	25	8. Yeoman	2
3. Eclipse	12	9. Atle	2
4. Minister	9	10. Yga Blondeau	1
5. Holdfast	4	11. N.59	1
6. Heine VII	3	12. Petit Quin Quin	1
13. Squarehead II, 14. Nord Desprez, 15. Jubilégem, 16. Welcome, 17. Alba, 18. Squarehead's Master, 19. Redman, 20. King II, 21. Victor II, 22. Little Joss, 23. Staring, 24. Pilot, 25. Alpha, 26. Masterpiece, 27. Aveling, 28. Franc Nord, 29. Lille Desprez, 30. Miana, 31. Garton's 60, 32. Victor, 33. Mado, 34. Banco, 35. Weibull's Standard, 36. Glasnevin Rosa, 37. Directoire Journée, 38. Druchamp.			7

A significant feature of the choice of winter wheats was the very low popularity of the best quality milling and bread-making varieties, Yeoman, Holdfast, and Atle accounting for only 7 per cent of the total. Price differences between high quality wheats and the French types have been far too small to encourage a change from a high yielding to a quality wheat. Lack of storage space on some farms rather than price considerations probably led most farmers to grow the quality wheats, which they hoped could be quickly sold and moved after harvest.

Spring Wheat Until recently, the leading variety, Atle, has had no serious competitors for yield or quality, and no other variety at present occupies a significant part of our spring wheat acreage. Now, after 16 years' supremacy, its position is being seriously challenged by Atson, while Atson in its turn is being challenged by Peko and Koga II. The latter attracted a great deal of attention last year in black fen districts, because of its ability to tolerate manganese deficiency to a degree not demonstrated by other spring wheats, least of all by Atle and Atson, which do badly on organic soils where manganese deficiency is common.

The appearance of some winter wheats in the county's spring list is explained by the fenland practice of sowing varieties like Hybrid 46 and Cappelle into the New Year.

Table 2

Spring Wheat

Varieties	Percentage Grown	Varieties	Percentage Grown
1. Atle	81	5. Atson	2
2. Hybrid 46	5	6. Koga II	2
3. Peko	3	7. Progress	2
4. Cappelle Desprez	3	8. Bersée	1
9. Fylgia, 10. Eclipse, 11. Petit Quin Quin, 12. Alex, 13. Miana, 14. Redman, 15. Minister, 16. Heine VII, 17. Staring.			1

Spring Barley In the three years since it was introduced Proctor has become immensely popular. Earl has always been popular in the county, and it is most likely that Spratt Archer and Plumage Archer are the two varieties that have suffered most from competition by Proctor.

Table 3

Spring Barley

Varieties	Percentage Grown	Varieties	Percentage Grown
1. Proctor	34	4. Herta	5
2. Earl	33	5. Plumage Archer	5
3. Spratt Archer	17	6. Carlsberg	4
7. Kenia, 8. Freja, 9. Maythorpe, 10. Rika, 11. Golden Archer, 12. Provost, 13. Pioneer, 14. Swedish Princess, 15. Boerna, 16. Glasnevin, 17. Domen.			2

Earl and Spratt Archer are still quite popular on the typical barley soils of the Cambridge chalkland, where malting quality is regularly aimed at and almost as regularly achieved. On the other hand, in the clayland areas, where malting quality is more elusive, Proctor has replaced the long-strawed types more rapidly; nearly half the barley acreage is now under this variety.

The very high yields given by Proctor in 1955 will undoubtedly lead to an increased acreage of this variety in 1956, despite the disappointing level of prices offered last season for good-looking samples of Proctor.

The two new introductions, Maythorpe and Provost, are naturally well down on the list, as only limited supplies of seed were available. Most interest is being shown in Maythorpe in view of its early-ripening qualities. The important question being discussed at present is whether Maythorpe's yield (probably about 8 per cent below that of Proctor) is too great a sacrifice to achieve the earlier start to the barley harvest. The standing ability of Maythorpe is so far a little in doubt, though it is clearly better than that of Earl, which it may replace.

The discussions and arguments on the Corn Exchange about malting barley varieties to be chosen for 1956 are more lively than for a decade or so. The financial implications of the recent new introductions have yet to be fully worked out, and the process is likely to continue for another year or two yet. Perhaps the most important factor will be the attitude adopted towards Proctor barley by the malting trade and the likely premiums to be gained from varieties popular with the maltsters.

Of the barleys not recognized as malting varieties, Herta quite properly heads the list, although the acreage is relatively small. It is, however, used to good advantage in heavy land districts, where its ability to outyield and stand better than Proctor is often more important than malting premiums.

Winter Barley Autumn-sown barley accounts for less than 5 per cent of the total barley acreage in the county. Half is sown with Plumage Archer and Earl, with Pioneer and Spratt Archer next in popu-

larity. The true winter variety, Pioneer, accounts for less than 20 per cent of the acreage. It must be remembered, however, that in a favourable December the sowing of spring varieties begins well before Christmas on the light chalk soils, and this in fact happened last year.

Oats Sun II and Blenda, judged on practical experience and trial results, are clearly the best spring oats for Cambridgeshire conditions, and together account for two-thirds of the acreage. For the future, the slight superiority of Blenda should wrest the leadership from Sun II.

Table 4

Spring Oats

Varieties	Percentage Grown	Varieties	Percentage Grown
1. Sun II.	37	6. Victory	5
2. Blenda	24	7. S.225 (Milford)	4
3. Black Supreme	9	8. Eagle	3
4. Star	7	9. Golden Rain	1
5. Onward	7		
10. Forward, 11. Pendek, 12. Resistance, 13. S.147, 14. Ayr Commando, 15. Ayr Everest, 16. Marvellous, 17. S.172.			3

Equally clear is the evidence that Black Supreme yields very poorly in Cambridgeshire—some 25 per cent below Sun II. If farmers growing this variety would change to one of the two leading varieties they could increase their income from oats by as much as £8 an acre. Rather smaller, but significant, benefits would follow the dropping of outmoded favourites like Star, Onward, Victory, and Eagle. The stiff-strawed Milford probably justifies its place for very fertile soils such as the fens.

Table 5

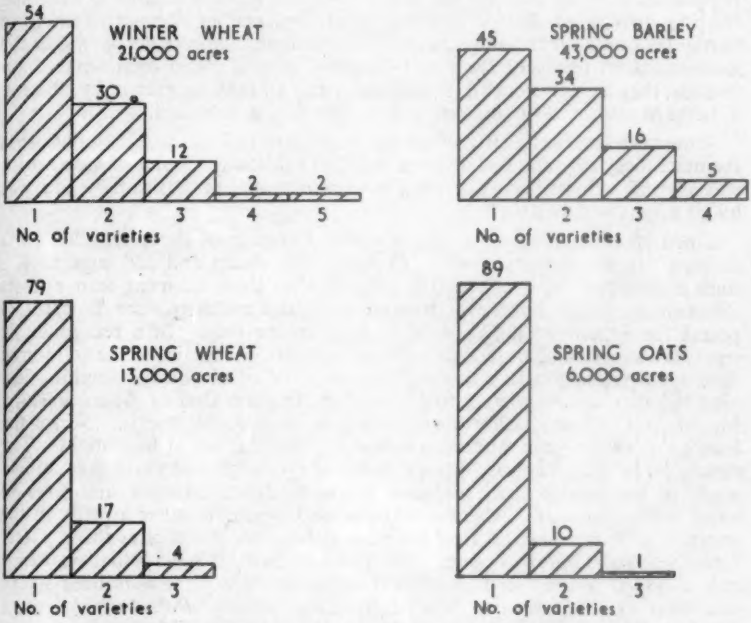
Winter Oats

Varieties	Percentage Grown
1. S.147	66
2. S.172	22
3. Grey Winter	7
4. Picton	4
5. Resistance, 6. Star	1

S.147 and S.172 occupy their expected and rightful position on the list. That Grey Winter should appear at all is rather surprising, for all the evidence shows it to be a poor yielder and very weak in the straw. The resistance of Picton and S.172 to Stem eelworm is recognized by their choice on farms where this pest is troublesome.

Number of Varieties per Farm Opportunity was taken to analyse the returns from the Variety Survey to provide information on the frequency with which more than one variety per farm is being grown. The distribution is clearly influenced by a number of different factors. The average acreage per farm of each kind of cereal is of importance, and the fact that, on average, only 10 acres of spring oats were grown per farm accounts for the fact that only a small proportion grew more than one variety. Another important factor is clearly the predominance or otherwise of one variety in terms of the percentage of the total acreage that it occupies. Thus the marked popularity of Atle in the spring wheat list probably accounts for the high percentage of farms which grew only one variety of spring wheat.

The picture presented by winter wheat and spring barley is markedly different. The spring barley pattern is most likely the result of varieties being chosen to fulfil two or more separate needs, an early-ripening variety usually being grown on the same farm as a late-ripening type. Thus Earl and Proctor are frequently found to be paired in this way, mainly with a view to spreading the barley harvest.



Percentage of farms growing different numbers of varieties

The winter wheat pattern is not so easily explained. The fact that only about half the farms grew a single variety probably indicates that farmers have not complete confidence in any one variety; or perhaps on many farms a second wheat variety is grown for some non-monetary advantage, such as the need for some good thatching straw.

Modern Varieties for Higher Farm Profits High profits on arable farms can be achieved in three main ways—by cutting costs, by increasing intensity, or by higher yields. The use of a better variety giving a 10 per cent increase in yield on a 9-quarter wheat crop will step up profit by as much as would be gained if the *total costs* of growing the wheat had been reduced by about one-third. The one is easy of achievement on farms where different varieties are being grown, while the other would be a quite impossible undertaking.

The choice of the right variety and its generous treatment with fertilizers is a comparatively easy way to higher yields and increased profits. We are therefore grateful to the 700 farmers in Cambridgeshire who have helped us to a fuller understanding of their choice of cereal crop varieties last year.

SMITHFIELD, 1955

FIVE days of farming at Earls Court brought 72,250 people to the Smithfield and Agricultural Machinery Show last month. There is general agreement that this is an exhibition *par excellence*, which with every succeeding year seems to add yet something more to its world-wide reputation. Of its 260,000 sq. feet, two-thirds was allotted to a wide and ranging display of British farming machinery and equipment, notable in particular for the increasing attention which manufacturers are giving to the mechanization needs of the small farmer. Roped off in their small compounds, they stand colourful, immaculate, and all looking extremely efficient, if perhaps a little self-conscious in such salubrious surroundings.

Some criticism was heard, of course, that there was too much emphasis on the machinery side and too little on stock, but this was a point of view which was seldom without bias—or shall we say personal enthusiasm?—and was by no means widely held.

Lined up for the judges were 334 cattle, 193 pens of sheep and 200 pairs of pigs. In the carcass section, 73 cattle, 160 sheep and 230 pigs took a final curtain-call in a consumers' market that likes its meat lean and its joints small. Light bone, even fleshing and quick maturity were the cardinal points for which the judges were looking in the ring. In a record cattle entry, the supreme championship went, by a narrow margin, to the pure-bred Aberdeen-Angus yearling heifer *Even Girl 3rd of Cobairdy*, weighing just over 10¼ cwt. and belonging to Major J. B. Gordon-Duff of Aberdeenshire. Mr. M. D. Holloway's Shorthorn *Lavington Sceptre* was reserve. So for the fourth successive year Aberdeen-Angus topped the bill at Smithfield. The champion is being kept by Major Gordon-Duff for breeding and thus, unlike many of her predecessors, escaped the auctioneer's hammer and lives to enjoy her supremacy. Aberdeen-Angus also won nine other awards in the interbreed championships, Beef Shorthorns four, second-crosses three, Herefords one, and Galloways one. The Duke of Norfolk's perpetual challenge cup, awarded to the breed society exhibiting the best three pure-bred steers, was won by a Shorthorn trio—*Lavington Sceptre, Ranworth Monarch* (Lt.-Col. H. J. Cator) and *Bapton Interpreter* (Mr. Cecil Moore).

Sir William Rootes captured the supreme sheep championship for the second year running from his Stype flock of Hampshire Downs—a really first-class matching pen of ewe lambs. The runner-up was Wing Commander R. Grant Ferris of Cirencester, with a pen of Southdowns. A pair of very even, well-matched pigs, with remarkable weight for age, gave the pig championship to the Large Whites, who indeed took all the honours except one.

The second day of the show saw some brisk bidding by butchers conscious of the prestige value which Smithfield meat could bring to their local trade. In the cattle auction, prices were £2 or so per cwt. above current market prices for prime beef, with considerably higher bids being made for the prize-winners. Thus *Lavington Sceptre*, weighing 11¼ cwt., sold for £405; the cross-bred blue-grey *Reunion* (Edinburgh champion and Smithfield reserve champion steer) for £380 at a little under 11½ cwt.; and the Queen's Red Poll steer (second prize in its class) for £210 at 9 cwt. 2 qr. 18 lb. In the sheep auction, the prize-winners again commanded some extra premium, but otherwise prices were, in general, only a few pence per pound above market prices. Later the champion beef carcass made the astronomical figure of £1,922—72*s.* a lb.!—an all-time Smithfield record.

S.R.O'H.

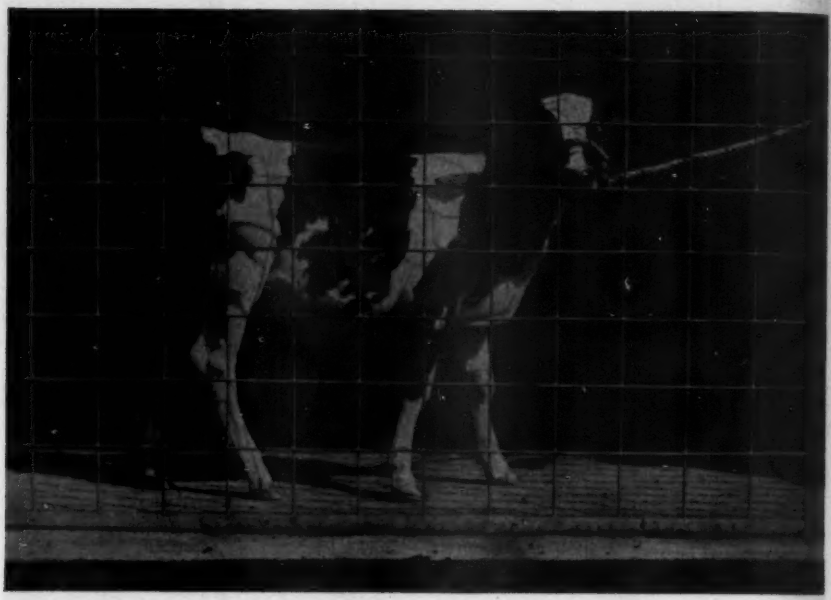
SMITHFIELD, 1955

Supreme Champion

EVEN GIRL
3RD OF COBAIRDY

(Owner:
Major J. B. Gordon-Duff)

Photo: *Verity Press*



Abruptly-weaned calf at 12 weeks.

Photos: *T. R. Preston*

Gradually-weaned calf, same age.

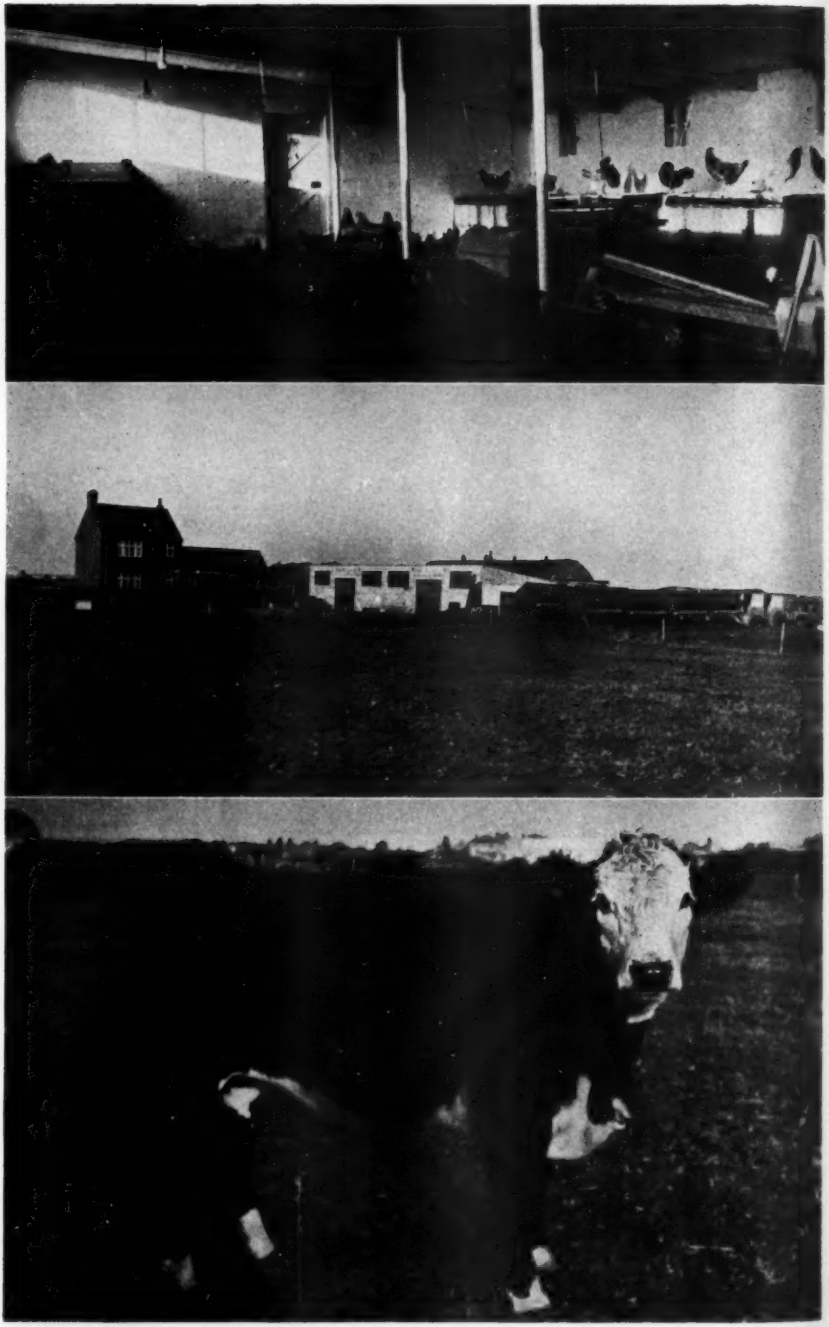
f Article on pp. 462-6)

Comparison at 12 weeks. The abruptly-weaned calf is on the left.

Photos: *T. R. Preston*

The calves together at 16 weeks.

Intensive Farming on a Small Scale (Article on pp. 471-4)



(1) The new deep-litter house. (2) Farm buildings (*left to right*): deep-litter house, turkey verandahs and piggeries. (3) Hereford × Aberdeen-Angus calf fattened almost entirely off grass.

DREDGE CORN

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National Institute of Agricultural Botany,
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Dredge corn has many advantages over a pure cereal crop for animal feeding, but success depends very largely on matching up the right partners in the mixture.

FOR the farmer who wants to be largely self-sufficient in concentrate foods for his livestock, there are considerable advantages in growing dredge corn. There is no doubt, in fact, that it could profitably find a place on many such farms where only pure crops of oats and barley are now grown. The inclusion of legumes in a mixture is largely a matter of personal preference, but when successfully grown and harvested they make a valuable contribution to the protein content of the produce, and this may well justify the risk attendant upon including peas in the crop.

Between 1946 and 1951 a series of trials* was conducted by the National Institute of Agricultural Botany to compare different dredge corn mixtures with pure crops of oats and barley. Eagle oats and Camton barley were the varieties selected, grown separately and in proportions by weight of three-quarters oats–one-quarter barley; half oats–half barley; and one-quarter oats–three-quarters barley. In all, there were twenty-two successful trials, and in nineteen of them a mixture was found to give a higher yield than either oats or barley grown alone. Expressed as a percentage value, taking Eagle oats as 100, the mean grain yields were:

Mean Grain Yields of 22 N.I.A.B. Trials

Eagle Oats	¾ Eagle–¼ Camton	½ Eagle–½ Camton	¼ Eagle–¾ Camton	Camton Barley
100	108	109	107	100

At the same time, trials were carried out in the South-West by the National Agricultural Advisory Service to determine the most suitable proportions of peas in cereal-legume mixtures. The results, so far as yields are concerned, were inconclusive, since performance varies from season to season. Thus it is rare for the quantity of peas in the final product to bear any relation to the proportion sown in the mixture. Rather is the limit set by the liability of the peas to cause lodging in the cereals. For the extreme South-West this limit appears to fall between 14 and 28 lb. of peas per acre, but possibly in drier districts the rate could be increased.

From the evidence of these two series of trials it seems, therefore, that where conditions are not likely to favour one species more than another, a half-and-half mixture of two cereals (or proportionately less if peas are included) will generally be the most satisfactory.

Besides the heavier crop to be expected from a mixture of grains, the trials demonstrated a further benefit over pure crops. This might be called the "insurance value". If one of the components of the mixture fails, the presence of the other is enough to give the farmer some return from the

* A full report of the trials was published in *The Journal of the National Institute of Agricultural Botany*, 1955, 7, No. 2.

crop. To take an example from our trials, in four instances the pure oats gave a mean yield of only 6.62 cwt. per acre—the failure being due mainly to Frit fly attack. In comparison, the half-and-half mixture in the same areas yielded 21.4 cwt. per acre (containing only 19 per cent oats). It is clear, then, that for areas where natural conditions make any one cereal a rather speculative crop, dredge corn has a very real value.

Where straw yields were recorded, there was evidence that the mixed crops gave slightly heavier yields than the oats alone. Little reliance can be placed on the actual figures, since moisture content was not calculated, but they corresponded with the observed increase in height of both cereals when grown together. Although mixtures in two trials appeared to resist lodging better than the pure crops, this was not generally the case.

The Right Mixture Before selecting varieties for inclusion in a dredge corn mixture, certain factors should be borne in mind to ensure the success of the crop. The first broad consideration should be to suit the types to the fertility of the land on which the crop is to be grown. On a soil of very high fertility only the stiffest-strawed varieties need be considered, and the inclusion of a legume would probably be undesirable. On the other hand, for a soil of moderate fertility there will be a wider choice of varieties, while peas would not greatly increase the risk of lodging. On an "early" site a late-maturing mixture, including wheat and beans, would perhaps be best.

To ensure the greatest measure of compatibility between the cereals selected for the mixture, several points need to be considered. Firstly, relative straw lengths are important. Excessive shading of a short variety by a taller or more vigorous one should be avoided, and if the crop is to be cut by a binder, the ears of the shorter cereal must be a reasonable distance above the bonds of the sheaves at harvest.

The table below shows the mean heights of a number of recommended (or provisionally recommended) varieties of oats, barley, and wheat. These are average figures taken from the demonstration plots of varieties grown separately at several N.I.A.B. stations during the years 1951-54.

Mean Heights of Spring Cereals (inches)

Oats				Barley			Wheat	
Sun II	Eagle	Maldwyn	Milford	Rika	Proctor	Atle	Atson	Fylgia
46½	43½	44½	38½	35½	34½	41	42	47½

It will be seen that, whereas oats and wheat are generally similar in straw length, the two varieties of barley are distinctly shorter. Here, therefore, a compromise has to be made, since the older, longer-strawed barleys, which are more comparable in length with the oats and wheat, would be too liable to lodging at the level of fertility suitable for the latter. In practice, under good growing conditions, both Rika and Proctor resist lodging well and the ears are well clear of the bond of the sheaves.

The second factor to be borne in mind is the relative earliness or lateness of the varieties. To avoid excessive losses through shedding at harvest, it is desirable that varieties grown together should be comparable in maturity. But the divergence in ripening dates among the recently introduced varieties of oats and barley is, in general, far less marked than between the older types, and in consequence the choice of varieties which will mix satisfactorily is now fairly wide. The average growth periods (that is, the number of days between sowing and reaching the binder-ripe condition) for the varieties mentioned previously are given below. Again, the information is taken

from N.I.A.B. demonstration plots. It illustrates just how limited is the range of maturity among the varieties in each species.

Growth Periods of Spring Cereals (days)

Oats			Barley			Wheat	
Sun II	Eagle	Maldwyn	Milford	Rika	Proctor	Atle	Atson	Fylgia
149	151½	148½	149½	151	155	169½	168½	165

These varieties are suggested as the most suitable of those available to farmers at the present time for dredge corn. It has not yet been possible to conduct full trials of mixtures containing varieties introduced recently. The following tentative suggestions are also advanced for the varieties likely to match fairly well in the mixture. These mixtures have been grown in observation plots at Cannington during the last three seasons and have given satisfactory results there.

1. *Sun II Oats with Rika Barley.* Similar in maturity, these varieties are suitable for a wide range of soils in good heart, as can be judged from their popularity when grown individually.

2. *Eagle Oats with Proctor Barley.* This mixture is suggested for the same range of soils as in Mixture 1, but will not be ready to cut until 3-4 days later. On the evidence of past variety trials with the separate crops, the potential yield would not be as great as from Mixture 1. Maldwyn could be substituted for Eagle in areas where it is known to do well.

3. *Milford Oats with Rika Barley.* Suitable for soils of very high fertility where Sun II would be expected to lodge. Under such conditions Rika may prove too weak in the straw, and Camton might be preferable. Except where other mixtures are likely to become badly lodged, this mixture could not be expected to give such a high yield as Nos. 1 and 2.

Wheat, Peas and Beans Wheat-oat and wheat-barley mixtures are also possible for dredge corn. The wide divergence of maturity between wheat and other cereals is, however, likely to lead to some loss of one or the other, although in a wheat-barley mixture loss from leaving the barley until the wheat is fit to cut should not be serious. It may be mentioned here that a mixture containing less than 25 per cent barley does not qualify for deficiency payment under the Government's guaranteed price scheme.

Peas and beans could be included in the mixtures, but these legumes are so dependent upon season that it would be impossible to forecast whether they would mature at a similar time to the cereals, and heavy losses might be unavoidable. Peas seem to do fairly well in western districts, where the weather is often wetter than in the eastern half of the country and the process of drying is consequently slower. The Minerva maple pea, bred by the Plant Breeding Institute, Cambridge, is an improvement on Marathon maple. Being much shorter in the straw, this variety has been found to climb the cereals quite well, holding its pods off the ground without pulling the cereals down. Beans could be included in a mixture of late-maturing cereals, or with wheat alone; this would be a good mixture for heavy soils, and here 25 per cent Camton barley might be included with advantage.

Growing and Harvesting Dredge corn is normally grown in the spring oat break of the farm rotation, and the varieties mentioned in this article are recommended only for spring sowing. Early sowing, provided adequate preparation of the ground has first been made, produces the highest yields, as with other spring cereals. It is especially

necessary for a wheat-bean mixture, which needs a long growing period. The crop will repay the farmer for a judicious application of fertilizers. Where peas or beans are included, any deficiency of phosphates or potash is likely to give the legumes a poor start. The acidity of the soil also needs to be considered, as both legumes and barley are very sensitive to a deficiency of lime.

Choice of the time of cutting is likely in most seasons to need some care, since it is rare for all the ingredients of a mixture to ripen together. An experiment at Cannington in 1953, where early- and late-maturing varieties of oats and barley in mixtures were cut at different stages of maturity, showed that, provided there was no great divergence in the ripening time of the cereals, delaying cutting until the barley was binder-ripe led to no loss of the oats. In fact, both the number of fully developed grains and the grain weight increased. But where there was a wide difference in maturity (for example, Onward oat and Camton barley, when the difference was sixteen days) delaying the harvest until the barley was ripe caused a loss of oats due to shedding, which was not made up by the increase in grain number and weight of the barley. Such a wide gap in ripening is not likely to be met with in the varieties recommended here, and growers are therefore likely to gain by waiting, in the case of an oat-barley mixture, until the later cereal is fit to cut. Where wheat is included, it will generally be necessary to cut the crop before the wheat is ready, leaving it to mature in the stook.

Since in most districts peas will ripen before the cereals are ready, they should not be used as an indication of the fitness of the crop as a whole. Oat-barley-pea mixtures are frequently combine-harvested, and this method may justify the inclusion of peas, since with no handling of the crop between cutting and threshing the loss of peas is considerably reduced.

Although most of the trials referred to in this article were carried out in the wetter parts of the country, those in the lower rainfall areas (20-30 inches) gave similar results, and the inference may fairly be drawn that in these areas too a mixture of cereals will give higher yields of grain than pure oats or barley, although the desirability of including legumes in the mixture has not been established. Therefore the farmer who plans to grow spring cereals for consumption by his own livestock now has a wide choice of high-yielding varieties with which to make a mixture suitable for his own conditions, and can expect not only a heavier crop but a product superior to either pure oats or barley for feeding purposes.

LETTUCE AND CELERY UNDER GLASS

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Lettuce and celery under cold lights are important and valuable crops in the rotations on this small Kent nursery.

AFTER trying various combinations of crops, both under glass and in the field, I have found that on this small but expanding nursery four crops suit our methods and fit in best together. They are: early tomatoes, followed by late chrysanthemums, under heated glass; lettuce, tomatoes, and midseason chrysanthemums under mobile Dutch houses on two plots; and lettuce, followed by self-blanching celery, under double-span Dutch lights. I am dealing, however, with only the last two crops in this article.

Taking lettuce first, we sow the seed on October 1 in single-span frames on a well-prepared seedbed. If possible, we prepare the frame by rotary hoe and burn off the weed seedlings with a flame gun, before firming and raking down the soil level for sowing. Under the double-span Dutch lights and some of the mobile houses, we prefer May King. May Princess was tried last year in frames, but we found it too prone to mildew and scorching. Probably we did not ventilate sufficiently, but May King grown alongside it turned out very well and was free from mildew. Possibly May Princess may do better in mobile houses if it is brought along and uncovered before it matures. I believe it is better suited for cloche work in this manner. Lobjoits Cos is the other variety which we grow under a mobile block. It follows nicely after the earlier-maturing May King, always makes a good price, and finishes just as our early tomatoes are coming along in quantity.

Careful Preparation for Lettuce After the seed is sown, the frames are dusted as a precaution against *Botrytis* and the treatment is repeated as soon as germination occurs. Air is given three days after germination to ensure hardy plants. As soon as the seedlings are big enough to handle they are pricked out, at two inches square, into another single-span frame that has been prepared with a liberal dressing of peat worked into the top three inches of soil with 1 oz. lime and 2 oz. superphosphate per sq. yard. This encourages a fine, fibrous root system and the plants lift easily at transplanting time. We have tried sowing thinly and not pricking out, but if the frames are not ready, or the weather is against us and planting is delayed, the plants get drawn and spoil. Pricking out first gives a more compact and sturdy plant. When the seedlings are established, air is given on every favourable occasion.

The double-span frames are dug in the early autumn, liberally dressed with farmyard manure or compost, and then covered until planting time. This ensures that however wet the autumn we can uncover the frames when we wish to plant and rotary hoe them to a good tilth. Fish manure, at 4 oz. per sq. yard, is incorporated at this stage, and the soil is trodden, raked level and marked out for planting at 9 inches square. All planting is done from boards laid on the soil, which leaves the soil level and so reduces the risk of *Botrytis* infection on the lower leaves. Planting is done with small home-made dibbers, and as long as the roots are well covered we like the plant to flop on the surface, rather than have its cotyledons and lower leaves below the soil. After a day or so they stand up again. After planting, the

whole frame is sprayed with a liquid slug-killer and again dusted against *Botrytis*. The lights are then put in place. Incidentally, we like the alternate-frame method of cropping, as it entails less work in moving lights. The empty frames are prepared for celery, and when the lights are required they are merely swung across the path straight on to the next frame.

We try to plant out during the first week in December, but if we cannot, then the second week in January is our target date. In fact, we have found very little advantage in December planting. Those planted in January usually get away faster and are in cut within a week of the earlier crop. Moreover, they usually suffer fewer casualties from slugs. Towards the end of January, or in early February, we like to go through hoeing very lightly with onion hoes to disturb the soil and encourage growth. We have also found that a dressing of "Nitro-Chalk" carefully applied between the plants before hoeing is very beneficial. At this time, all dead, diseased and yellow leaves are removed. A decided increase in growth is noticeable after this hoeing. With May King. as the days get warmer in March and the crop approaches maturity, a judicious airing is given each day.

When cutting starts, we work in teams of two. One person cuts and lays the lettuce bottoms upward on the glass of the previous light; the other trims, grades, and packs straight into lettuce crates lined with two sheets of greaseproof paper. The cutting is done before ten o'clock to avoid the possibility of cutting in warm sunshine, and the packed crates are taken to the packing shed to await transport to market. The cos lettuce receive the same cultural treatment as May King, but since we aim at planting tomatoes on April 20, the house is moved off the lettuce on April 17.

Successive Sowings of Celery The celery is sown in seed-boxes in heat on March 1, and subsequently at intervals of four days until the 13th. The variety we use is Tozer's Golden Self-blanching. As soon as the first rough leaf is showing, the seedlings are pricked off into seed-boxes filled with old chrysanthemum compost, to which has been added some J.I. base fertilizer at the rate of 4 oz. per bushel. As the seedlings do not occupy the seed-boxes for more than 5-6 weeks at the most, we do not consider it necessary to make up a special mix of true J.I. compost, and our results have so far been very gratifying. The seedlings are spaced 6 by 9 in each box, which is then left in the propagating house for three days. At the end of this time the seedlings have started to move again, and the boxes can be removed to a cold Dutch light for gradual hardening off. The frame is kept closed for about a week, unless the sun is exceptionally hot, but thereafter air is given daily. After a fortnight the lights are removed altogether on fine, sunny days. The soil in the boxes is never allowed to dry out, and about mid-April a dressing of "Nitro-Chalk" is given. The successional sowings are made so that we can plant up the frames at intervals, and thus stagger marketing.

The celery frames are given a heavy dressing of compost, dug, and left rough over the winter. A dressing of fish manure and "Nitro-Chalk", both at 2 oz. per sq. yard, is applied before planting, and then the frames are rotary-hoed, raked level and marked out for a 9-inch square planting. The latter begins in the first week in May. We always soak the boxes well before knocking out the plants and we also find it pays to ball-water each plant before the lights are put on. This prevents flagging and scorching, as the sun can be quite strong at this time of year. The frames are kept closed for the first week. At the end of the week the plants are watered well and air is subsequently given daily—on one side for three days and then on both after that. At the end of the second week ventilation is given day and night

for a further week, by which time the front plants are touching the glass if the lights are lowered. The glass is then removed altogether.

I have found that with heavy watering given at least once a week by means of a hose and rose, the soil at Sholden tends to pan down, and so we try to go through the frames with onion hoes in the third week just to keep the soil stirred and open. In any case, we do this as soon as the lights are removed, and give a dressing of "Nitro-Chalk" at the same time. From the time the lights are removed until digging begins, the only routine work necessary is weed control, watering being done by spray lines. One more dressing of "Nitro-Chalk" is given about four weeks after the frames come off. Celery fly is controlled by spraying malathion as soon as the lights are removed and, if necessary again, at least a month before marketing.

Packing Celery for Market Digging starts sometime between the middle and the end of July, according to the season. Not having a washing machine, we have found the following method of packing to be the quickest. After the first few rows of celery have been dug, we lay lengths of corrugated iron along the centre ridge of the frame, supporting them at each corner with lettuce crates, to form an easily-moved bench. An old iron bath is then placed in the middle of the bench. One person digs and lays the sticks against the front board on either side of the frame, clearing right across twelve rows at a time. The trimmers, one each side, leave the trimmings in the path and place the sticks on the bench for the fourth person, who scrubs, grades, and packs them in lettuce crates lined with greaseproof paper. The counts are 16s, 20s and 24s. The sticks are laid all one way in one row, and in the opposite direction in the next row. This gives a neater looking pack than packing them head to tail in the same row, and for some reason also enables us to get four rows in the crate instead of three!

I have found that trimming is the bottleneck in the operation, and that is why two trimmers are employed; the digger and packer can easily keep pace with them. On occasions, we have worked successfully with a team of three, but here the digger gets so far ahead and then drops back to help with the trimming. As work proceeds down the frame, the bath is moved along the bench and the sheets of iron are leap-frogged one over another. This method gives us a smooth flow from the digging to the finished crates and reduces movement and handling to the minimum. We have, in fact, applied our own time and motion study here!

Celery digging finishes about the third week in August, and by then we are getting busy with early chrysanthemums, tomatoes, and the routine work on the midseason and late chrysanthemums. So we stack our lights. On average, these two crops together bring in a gross return of over £1 per light.

One further point that may be of interest is that we have either 6- or 9-inch front boards for the frames that have celery in them; they help to keep the sticks in the outside rows from getting too green. In one frame last year I had an extra row each side planted against the board as a dummy, to see if it would help to blanch the outside row better. These dummy plants did not come to much, but I think they kept the light off the next row, which was all that was intended. Anyhow, I shall try it again this year to see if it is really worth while.

LIQUID FEEDING FOR GLASSHOUSE CROPS

G. F. SHEARD, M.Sc.

Director, Fairfield Experimental Horticulture Station, Kirkham, Lancs

Last month Mr. Sheard dealt with the value of trickle irrigation for glasshouse crops and the quantity of water required. In this second article he offers some advice on the best way to mix, dilute and inject a balanced feed into the watering system.

WHEN the water needs of a tomato crop are supplied by trickle irrigation, the fertilizers normally given as top dressings have to be applied in soluble form through the irrigation system. They cannot be applied as dry mixtures to the soil surface and just watered in. Liquid feeding can, of course, be used with hose watering; it is not specific to trickle irrigation systems. The method briefly consists of dissolving the soluble fertilizer mixture in water to give a concentrated solution and injecting this into the water flow to the trickle harness or hose, so that a very dilute solution is applied to the soil for immediate use by the plant.

A plant can take up its nutrients only as very simple radicles in water solution. When more complex organic or inorganic materials are applied to the soil as fertilizers, they must first be broken down by soil bacterial action into simple forms before they become available to the plant. The use of fully soluble, simple fertilizer mixtures by-passes these breakdown processes, so that not only is growth response rapid, but the nutrient materials are more efficiently used and there is less chance of loss by drainage and immobilization in non-available forms.

On many older nurseries yields are low because of a high accumulation of soluble salts in the soil. The salt concentration gradually builds up over a number of years, mainly due to the high rate of fertilizer use, and yields eventually become uneconomic. This condition is normally manifested as an accumulation of sulphates, particularly calcium sulphate. Excessive use of superphosphates is one of the primary causes of the trouble, since superphosphate is about one-third calcium sulphate. The latter salt can also accumulate in the soil as a result of using heavy dressings of the sulphates of potash and ammonia, the sulphate radicle in these materials combining with the lime in the soil to form calcium sulphate. Water supplies containing calcium sulphate can also aggravate the trouble. Liquid feeding lessens the risk of this condition appearing on newer nurseries and can be used to alleviate the condition on old nurseries, since the feed can be made up from materials containing only nitrogen (either as ammonia or nitrate), potash and phosphate, without calcium sulphate or other undesirable radicles.

Before considering the composition of liquid feeds, it might be profitable to consider the major nutrient requirements of the tomato. The following table, showing the average nutrients applied to the soil and removed from it in the form of fruit, trimmings, leaves and debris by a 50 tons per acre main crop of tomatoes, is based upon the figures published by Owen.* The first

* The Analysis of Tomato Plants. O. Owen. *J. agric. Sci.*, 1929, **19**, 413-32.

set of figures in each column refers to nitrogen as N, phosphate as P_2O_5, and potash as K_2O. The figures in brackets give the equivalents in sulphate of ammonia (20.6 per cent N), superphosphate (18 per cent P_2O_5), and sulphate of potash (48 per cent K_2O).

	Nitrogen		Phosphate		Potash	
	lb.	*cwt.*	*lb.*	*cwt.*	*lb.*	*cwt.*
Dung (40 tons per acre) ...	539	(24)	358	(18)	448	(8)
Base fertilizer	112	(5)	120	(6)	162	(3)
Top dressings	135	(6)	80	(4)	448	(8)
Total	786	(35)	558	(28)	1,058	(19)
Removed by crop	429	(15)	70	(4)	875	(15)

The figures point to a very high requirement of potash and nitrogen, and a low requirement of phosphate. The tomato plant appears to take up its nutrients in the ratio of 12 K_2O:6 N:1 P_2O_5, with a potash-nitrogen ratio of 2:1. If adequate dressings of dung are given, there is little need to apply additional phosphate on established nurseries, unless recommended by a soil chemist. After allowing for losses and non-availability of nitrogen and potash in the dung and base dressing, it seems reasonable to assume a requirement of about 600 lb. K_2O and 300 lb. N in the liquid feed. Feeding normally takes place for 15-20 weeks and, on this basis, the weekly requirement would be 40 lb. K_2O and 20 lb. N.

These assumptions may be open to criticism. It must be admitted there is a dearth of information on which to work and the figures above are an attempt to put plant feeding on a more realistic basis.

A Balanced Mixture A grower may buy proprietary mixtures either in concentrated solution or as solid mixtures for making up into a concentrated solution. Liquid concentrates tend to be expensive, due to the high carriage costs on the water, but are convenient and easy for the small grower to use. But with all proprietary mixtures the user is limited to the types marketed, and these may not always have the composition desired.

Liquid feeds can be made up by the grower himself, using mixtures of ammonium nitrate, potassium nitrate and, where phosphate is required, mono-ammonium phosphate. Technical grades of these chemicals have the following approximate analysis:

	Potash (K_2O) *per cent*	Nitrogen (N) *per cent*	Phosphate (P_2O_5) *per cent*
Potassium nitrate	42	13	—
Ammonium nitrate	—	35	—
Mono-ammonium phosphate ...	—	11	48

Urea (35 per cent N) can also be used as a source of nitrogen, but may be difficult to get. Sulphate of potash can be used as an alternative source of potash but the nitrate is to be preferred. Mixtures of any desired composition can be made from the above materials, and the table overleaf shows the proportions and weights required for those most generally used.

A potash/nitrogen ratio of 2:1 should be used as the standard for most varieties of tomatoes, but this can be varied during the season to change the type of growth or improve fruit quality. A 1:1 ratio may be found better for the variety Potentate and can be used on other varieties if growth is weak. Straight nitrogen can be used for short periods but care is needed, otherwise fruit quality will suffer.

Mixing of Fertilizers for Balanced Feeds

Proportion			Application			Weight of Fertilizer Needed		
K_2O	N	P_2O_5	K_2O	N	P_2O_5	Potassium Nitrate	Ammonium Nitrate	Mono-ammonium Phosphate
			lb./acre/week			*lb./acre/week*		
	1			20		—	56	—
1	1		20	20		48	40	—
2	1		40	20		94	22	—
3	1		60	20		142	—	—
1	1	1	20	20	20	48	26	42
2	1	1	40	20	20	94	8	42
3	1	1	60	20	20	142	—	42

Preparing the Feed Ammonium nitrate and mono-ammonium phosphate dissolves readily in water, but it is difficult to dissolve more than 2 lb. potassium nitrate in a gallon of water at normal temperatures. For easy mixing and to avoid the risk of crystallization, one gallon of water should be allowed for every pound of potassium nitrate. The concentrate can be made up in quantities sufficient for immediate use, or in bulk in a tank or barrel to be drawn off as required.

The weekly amount of feed should be divided into six equal parts and applied with the calculated amount of water on the six working days. This avoids anything other than straightforward watering on Sundays. The daily feed will be fixed but the amount of water applied with it will vary with the weather. Dilutions as low as 1 : 500 (weight of fertilizer to weight of water) can be used without damage to the crop. To avoid confusion and to facilitate checking the weight of fertilizer applied, it is best to work to dilutions as weight to weight, rather than volume to volume. A volume to volume dilution means little unless the weight of fertilizer in the concentrate is stated. It is not known whether the rate of dilution is important or whether it should be kept constant or varied over the season. Provided the dilution is a safe one, it is best to apply the calculated amounts of feed and water and let the dilution vary accordingly. There is some evidence that very good results are obtained when a constant dilution rate of 1 : 1000 is used in the feed, and the feed then applied in proportion to the water requirement, but further work is needed before any definite recommendations can be made.

Costs and Savings The fertilizer concentrate has to be introduced into the main water flow, and some form of dilutor is required. The simplest form is a drip feed discharging into the header tank. The most commonly used pattern works on the principle of by-passing a part of the main water flow and using this to displace an equal volume of concentrate back into the main water stream. This type is accurate for most conditions and will operate over a wide range of dilution. The dilutor may be built as an integral part of a special concentrate container, or it can be made to fit over the normal glass carboy or over a plastic container of between ½ and 5 gallons capacity. The output varies from 300 to 1,000 gallons an hour and the cost from £5 to £40, according to type. Such an installation is most suitable for the small to medium sized nursery: where a high output is required it is best to use a mechanical proportioning device. This is very accurate but costs upwards of £180 per unit.

LIQUID FEEDING FOR GLASSHOUSE CROPS

The cost of installing trickle irrigation and liquid feeding is approximately £700 per acre, and the life of the equipment is likely to be at least five years. From our experience at Fairfield, there is a saving in labour of two men per acre for the four summer months. At present rates of pay, this amounts to about £250, and on this basis the capital cost should be recouped in three years. This saving of labour may not be directly effected but should show in an easing of labour demand at peak season, better control of growth, more efficient use of fertilizers, and higher yields of better quality fruit.

THE FARMER AND HIS ACCOUNTS

S. V. P. CORNWELL, M.A.

Planning for profits requires keeping a close check on the farms' figures. Mr. Cornwell emphasizes in particular the importance of management accounts.

MOST farmers dislike having to do accounts, and few prepare their own: they employ accountants. Instinctively they distrust the annual accounts as being another man's magic, do not understand them, and think of them rather as being a lever for extracting still more tax from their own pockets. These misconceptions—for such they are—are serious, both for the farmer himself, and for the economy of the country. Accordingly, the first object of this article is to explain how accounts which, besides determinging the liabilities to income tax, are of essential use to the farmer in managing his farm. They can be prepared with *no* additional time, trouble or expense. To distinguish these two purposes, the two types of account will be referred to as " Management Accounts " and " Tax Accounts ".

The second object is to show the various uses to which the farmer can put his management accounts. If the accountant is to be in a position at the end of the year to draw up useful management accounts, the farmer must give some help during the year, and comply with certain simple rules. The important word is *simple*.

The Farmer's Obligations The farmer must undertake to pay all items of expenditure by cheque, with the exception of " minor outgoings ", and he must enter on the cheque counterfoil the nature of the expense, for example, " feedingstuffs ", or " tractor repairs ". A minor outgoing is that weekly amount which, having regard to the size and nature of the farm, the farmer's accountant can show to the Tax Inspector as being reasonable petty cash outgoings, not recorded in detail. This is purely a tax problem, and the only man who knows the answer is the accountant. What the ordinary farmer does not realize perhaps is that if he does not restrict his weekly petty cash payments to such a limit, he will probably pay more tax than is necessary.

The farmer must also undertake to pay into the bank *all* his takings, and at the same time to keep a record of their nature and source. There is no need for an elaborate cash book; the record can quite easily be kept on the counterfoil of the farmer's bank paying-in book, which will contain such

entries as " Barley Sales ", or " Milk Cheque ". It is a help, of course, if the farmer can keep his receipts, etc., in some sort of order, but it is not essential. The third thing the farmer must do is to make a definite decision each year about the valuation of his stock in hand. This matter, which needs some detailed consideration, is dealt with below.

These are the minimum requirements, and they are not really very much more than the average farmer does anyway. The point is that if the farmer will do these three things, then his accountant can produce, with no more time and trouble than it would take him to prepare accounts for the Tax Inspector, accounts which will at the same time be a very useful tool to the farmer in managing his farm.

The Annual Stocktaking Let us look at the question of stocktaking. The first thing is for the farmer to decide whether his normal valuation of tillages, unexhausted manures, and growing crops is likely to exceed £700. If it does not, the Inland Revenue will normally accept a certificate that the value at the end of the year did not materially differ from that at the beginning of the year: and in that case a detailed valuation can be dispensed with. If the valuation is going to be more than £700, then either some records of quantities can be kept, and the value discussed by the farmer with his accountant, or, on the larger farm, it may be preferred to call in a valuer each year.

It is *not* necessary that the implements and machinery should be valued annually. This is a matter which the accountant can deal with: he has to keep records of capital equipment in order to obtain the tax reliefs available to the farmer, and from these records he can do a book valuation each year, which is all that is necessary for tax purposes, and is also far more valuable from the viewpoint of operating results than an annual valuation by a valuer.

If the farmer has observed the three simple rules set out earlier, all he has to do at the end of the year is to give his accountant his counterfoil paying-in books, counterfoil cheque books, and his bundle of receipts, and from that point, the accountant can prepare accounts to serve various purposes (dealt with below) with no more effort or expense than would be involved in making up Tax Accounts.

The Accountant's Obligations The accountant's duties are also simple: they are: (a) to draw up the Final Accounts on management lines, in the form set out below, and (b) as part of this duty to undertake an analysis of payments sufficient to distinguish between the main heads of expenditure set out in the standardized form of account below.

The accountant will also agree with the farmer (where appropriate) a schedule of debtors and creditors at the year end, and will calculate depreciation on the fixed assets.

The main heads of a standardized form of farm accounts, giving all the information which in the ordinary course either the farmer or the National Agricultural Advisory Service officers require, are set out below:

Income:

Livestock receipts, distinguishing between categories of livestock.
Crop receipts, distinguishing between types of crop.

Expenditure:

Labour;
Foodstuffs:
Rent or Net Annual Value;
Livestock by types of animal:
Fertilizers;
Seeds;
Fuel;
Equipment hire;
Transport and miscellaneous;
Implements and machinery.

The accountant can also, as part of this technique, provide any special analysis of the heading "Miscellaneous", which either the farmer may desire or which the accountant may consider desirable for tax purposes, or which—if the National Agricultural Advisory Service has been consulted—the District Officer may consider useful. The point of this standardized form of Management Accounts is that the heads of expenditure are such that they can be compared with the figures of "national averages" published in the Ministry of Agriculture's annual analysis of Farm Incomes in England and Wales and with the reports on farming issued by the Provincial Agricultural Economists.

Uses of Management Accounts It may once have been true that it was enough for the intelligent farmer to guess at last year's performance in planning the next year's programme. It is certainly true no longer. The impact of subsidies, the shortage of labour, the cost of feedingstuffs, the increasing fixed capital in machinery and equipment that is necessary, these and other factors make it *essential* for the farmer, who wants a profit, to have accurate records of past performance on which to base his plans for the ensuing year. There is also an increasingly wide range of alternative policies open to a farmer; and intuition alone is no longer enough.

The immediate advantages, therefore, of Management Accounts are to the farmer himself. They give him a firm base from which to plan profitable farming policies for the future—that is to say, they will give him accurate information about the existing level of costs on his farm, so enabling him to plan his next year's cropping or livestock programme in such a way that the income to be anticipated from it will more than cover his costs. Put the other way round, this means that the farmer has a certain minimum level of costs, and he must try and plan so that his income exceeds this level. Secondly, such accounts enable the farmer to exercise control over his expenditure more closely. As farm planning becomes increasingly complicated, it becomes more and more necessary to relate expenditure to the income derived therefrom, and to control expenditure with regard to the income that is expected from it. This can be achieved if, as soon as he has his accounts, the farmer compares them either with the national "average" figures, or with the average figures for the locality (depending on the type of farming he is practising). This comparison should show the farmer where his costs for the previous year have been unnecessarily high, or where he has incurred unnecessary expenditure. If the farmer finds difficulty in working this out himself, he and his accountant can usually put their heads together on the matter. Thirdly, management accounts provide a basis upon which, if the farmer so desires and the need arises, he can erect a rather more elaborate system of accounting for any individual enterprise—for example, intensive milk production.

The wider advantages that would flow from a more general adoption of management accounts in farming arise from the existence of the National Agricultural Advisory Service and its organization of District Officers. Such accounts should enable the N.A.A.S. to develop and extend the greater emphasis which is now being placed on farm management advisory work. In the past, the absence of accurate records of expenditure and income has too often meant that the N.A.A.S. have had to limit their advice to purely technical factors—for example, to specialist advice on increasing any particular form of output.

But if management accounts were available, the N.A.A.S. could pay much more attention to the effect of their advice on the farmer's *profits*. For

instance, a N.A.A.S. officer might be called in to advise on two farms, on each of which the purely natural conditions are exactly similar. But his technical advice (say, on getting the maximum output from a given field) even though it is in itself perfectly correct, might on the one farm give rise to a profit, but on the other might lead to a loss. The reason is that the level of costs to which the two farms are respectively committed may differ widely.

But with adequate records of past expenditure, and full information as to the level of costs to be expected on that farm, the advisory officer could give his advice with reference to profits—that is, he could measure the probable effect of the technical advice he was in a position to give, on the farmer's level of profits.

Management accounts give the farmer a very much more accurate guide than anything else. If he has compared his figures with the averages for the locality on the lines mentioned above, he should be able to see clearly whether or not his farm is being run efficiently. If it is not, there is obviously a case for seeking other advice. Thus the existence of some form of standardized management accounts would facilitate the work of the N.A.A.S.

Farmers should realize that in every other industry management accounts have come to stay. More and more use is being made of them, and more and more industries are finding them indispensable. The reduction of costs, and planning with a view to profits, are almost impossible without such accounts. The farmer can no more afford to neglect his costs and his profits than can the industrialist.

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Two booklets, compiled by the Ministry in collaboration with the Inland Revenue Department, deal clearly and simply with the keeping of farm accounts and with Income Tax as it affects the farmer. They are:

Farm Book-keeping (price 1*s.*; 1*s.* 1½*d.* by post)
Farmers' Income Tax (price 1*s.* 6*d.*; 1*s.* 7½*d.* by post)

Copies of these booklets may be obtained from any of the Government Bookshops listed on p. 506, or through a bookseller.

FARMING AFFAIRS

Farming History Conference Farmers, industrialists and scholars from all over the country attended a joint meeting of the British Agricultural History Society and the Association of Agriculture, at London University on December 3. Sir James Scott Watson, the Society's President, was in the chair. Of the three papers read to the meeting, the first by Mr. Hamshaw Thomas (University School of Botany, Cambridge), dealt with the life and writings of Richard Bradley, who lived in the early eighteenth century. Bradley came very close to some of the most modern scientific discoveries. By a series of experiments he found that variegated leaf colours could be induced in healthy plants by grafting scions of discoloured plants. The variegation (which is really a virus disease) was, he found, transmitted through the circulation of the sap. Similarly, he was able to produce the breaking of tulip bulbs—a discovery which was forforgotten or neglected until Sir Daniel Hall, all unknowingly it is thought, repeated Bradley's experimental work on modern lines. Until now, Bradley has generally been regarded as something of a charlatan, but Mr. Hamshaw Thomas's work has done much to retrieve his reputation.

In the second paper, Professor Cyril Tyler of Reading University dealt with the historical development of feeding standards for livestock. He recapitulated the theories of the ancients and the slow progress that was made in gaining real knowledge of feeding until von Thaer's pioneer work in the early nineteenth century. It was unfortunate that von Thaer chose such a variable commodity as good hay for his basic unit, but his work pointed the way. Many German and English chemists followed in his steps to provide the information which today allows us to lay down simple and practical rules for breeder, dairy farmer and meat producer alike.

The last paper was rather more recondite. It dealt with pollen analysis and its bearing on agricultural history, and was given by Mr. J. W. Franks (University College of Leicester). Mr. Franks demonstrated how it is possible to discover what happened in districts now covered with peat or fen by cutting down through the soil. The depth of the layers and other signs indicate how long the deposits have taken to accumulate, and, by carefully collecting, identifying and counting the pollen embedded and preserved, the flora of a particular age can be deduced. If man lived there, his activities in growing cereal or other crops, or the effect of grazing animals, can be clearly seen.

Anyone interested in the work of the British Agricultural History Society should write to the Hon. Secretary, Mr. J. W. Y. Higgs, at the Museum of English Rural Life, Reading.

G. E. Fussell

Farm and Forest: 10. Planting the New Woodland Last month's note dealt with the preparations necessary for afforestation on various types of land. We can now consider the species of trees to be planted on the sites selected, and the protection of the plantation against damage by animals. Hitherto, rabbits have been the major pests in new plantations, and where rabbit-proof fences are still needed they should be constructed of 42 inch, 18 gauge, 1½ inch-mesh netting, so fixed that the bottom six inches can be turned out horizontally and secured by turves. The top should be attached to a well-strained No. 8 plain wire and the whole supported by stakes 5 feet 6 inches high, spaced 12 feet apart. If a stronger fence is needed, another strand of No. 8 wire can be used in the centre of,

but behind, the netting, and the distance between the stakes reduced to 9 feet. Where it is necessary to erect such a fence against sheep and stock as well as rabbits, it will have to be strengthened by using more strands of plain, or barbed, wire.

The choice of species depends not only on the type of ground to be planted, but also on whether the provision of shelter or the production of farm timber is the primary aim. Larch, being deciduous, is not as good for shelter as an evergreen tree, but as fencing material it is excellent and needs no preservative treatment. Scots or Corsican pine are good evergreen trees for shelter, but their timber requires creosoting for use in the open. Rate of growth and, hence, early production of timber, is another important consideration, often manifesting itself in a preference for conifers, and sometimes poplar.

Apart from these basic considerations of rate of growth and use, the choice of species is essentially linked with the type of land available. Thus it can be said that the lighter, drier and sandy heath soils are generally most suited to the pines. On bracken sites, the larches should be the choice, the Japanese larch preferring the wetter areas of the western part of the country. On thin downland over chalk, beech is considered a suitable tree, especially if protection is available in the form of thorn, elder, hazel and so on. A "nurse" species, such as pine, can also be used with beech. This provides protection for the beech in the early stages of growth and ensures an early return in the way of thinnings when the pine is removed to allow the beech to grow on to a final crop. In the wetter, grass situations the spruces are recommended, the Norway spruce being used where frost is likely. Spruces can also be used on deep peat with grass vegetation. Sitka spruce usually does well at the higher elevations and on the more exposed sites. On the deep clays, oak, with Norway spruce "nurses", is preferable. As with the pine-beech combination, there are early returns in the way of thinnings, which may include Christmas trees as well as poles.

Douglas firs like a well aerated soil of an open, rather than clay, texture, but are unsuitable for exposed places. Other conifers less frequently used but often worth planting are *Thuja plicata*, the Western Red Cedar; *Tsuga hetrophylla*, the Western Hemlock; and *Abies grandis*, the Grand Silver Fir. All are evergreen, grow remarkably quickly and thrive on soils of quite moderate fertility. Certain species of poplar should be considered for moist, fertile situations.

The Mechanic on the Farm: 21. Electric Battery Maintenance Tractors, lorries, cars, combine harvesters and electric fences are all dependent to a greater or less extent on one small piece of equipment—the battery. The wise farm mechanic will pay particular attention to the batteries in his charge, for not only are they expensive to replace, but their failure can also cause a good deal of delay when it comes at an awkward time. Careful use and regular maintenance will, however, do much to prolong the life of the battery.

After every fifty hours of use, distilled water should be added to the battery until the liquid covers the plates. If a lot of water is needed in the starting battery of an engine, the dynamo has probably been charging the battery at too high a rate. In circuits not having an automatic voltage regulator, the charging rate can be governed by moving the third brush to a new position. But overcharging can still occur, even when a controlled charging system is in use, if the capacity of the battery is reduced by sulphation.

The battery connections must be kept tight and clean, lest the current from the dynamo finds it easier to pass through the equipment circuit of

the tractor or lorry than through the battery. Ammonia will help to clean away the sulphate on terminals, and petroleum jelly will delay further formation. In very cold weather the engine should be run for a minute or so before any lamps or equipment are turned on, so that the generator voltage can adjust itself to the high resistance offered by the cold battery.

Vibration is bad for the plates, so the battery of tractor or lorry must not be loose in its box. It is also dangerous, however, to have the holding-down bolts too tight, because excessive pressure may warp the battery container, break the partitions between cells, or crack the sealing compound. If there is room between the battery and the base, sides and top of the case which holds it, it is as well to pack the spaces with strips of rubber sheet (pieces cut from an old inner tube will do), to absorb shock.

The sulphuric acid solution should show a specific gravity of 1.28 when the battery is fully charged. The solution must not be allowed to be more concentrated than this. Acid can be lost from the battery only by spilling, and therefore the only additive needed is distilled water. Since it is difficult to pour from a jug into the small openings in the top of the battery, it is worth while buying or making a pipette to deliver a controlled stream of water capable of being stopped as soon as the plates of the battery are covered. A rubber connecting pourer, which fits on a bottle, can be bought very cheaply. By an ingenious arrangement of the levels in the rubber connectors when the bottle is inverted, the flow of water stops when the level of electrolyte is at the required half-inch or so above the plates. If electrolyte is spilt on the battery, it should be wiped off with a rag dipped in ammonia. The top of the battery should also be kept free from dirt.

To estimate the state of charge of a battery it is necessary to find the specific gravity of the electrolyte—normally by means of a hydrometer. The usual type of hydrometer for battery work is enclosed in a syringe, the solution being drawn up into the syringe so that the hydrometer floats in it. Provided the concentration of acid in the solution first put into the cell was correct, a specific gravity of about 1.28 indicates that the cell is fully charged; a reading of, say, 1.11 means that the cell is run down. Batteries on tractors and vehicles in general use ought not to need any charging from an external source, but a mains trickle charger is worth while to charge fence batteries and to make good the loss from any engine batteries which are used infrequently. No battery should be left in a discharged condition. The lead sulphate becomes hard and crystalline, and expands so that it warps the plates.

H. J. Hine

Country Craftsmen Today, just as much as in the past, the country craftsman has an important part to play in country life, and it is to help him fulfil that part that the Rural Industries Bureau has provided its valuable service of advice and instruction. Always the objective is to marry traditional skills to modern needs. New outlets must be found for the craftman's products and services, and he must learn how to make use of new materials, tools and techniques. Life in the countryside is changing rapidly and the craftsman must change with it. For instance, few smiths can now make a living by farriery or general forge work alone; instead, many have learned to repair agricultural machinery and tractors. During the past fifteen years instructors from the Rural Industries Bureau have been teaching country smith-engineers to use welding apparatus in the making and repairing of machine parts. So now the farmer in an isolated district will find the skill of his local smith-engineer of inestimable value; for example, instead of having to wait several days for a spare part, he can have one made to his requirement on the spot.

The Bureau was quick to recognize that among the newer agricultural

machines the combine harvester and the diesel tractor would demand skilled attention. A number of training courses, at which smith-engineers have been taught how to service and repair these machines, were therefore introduced. But for these new tasks the country smith had to have more equipment, and, with the assistance of the Bureau and its associated Loan Fund, many have transformed their smithies into engineering workshops. In this way the traditional skill of the country smith is being preserved and adapted to modern economic needs.

The Bureau's help is given to many country crafts and small industries, including brickyards (producing tiles, land drainage pipes and hand-made facing bricks), carpenters, furniture-makers, wrought-iron smiths, potters, thatchers and boat-builders. A high standard of design as well as craftsmanship is necessary if the hand worker is to meet competition successfully, and the Bureau assists by providing a wide range of designs which a small craftsman could not afford to commission for himself alone. Nor are the economics of running a small business neglected by the R.I.B. Far too often in the past the small enterprise has failed because of lack of attention to costing and book-keeping. The Bureau provides instruction in both subjects, as well as giving advice on marketing and general business problems.

The work of the Bureau is more fully described in their Report for 1954-55, *Hand and Machine in the Country*. Copies of this report may be obtained from the Rural Industries Bureau, 35 Camp Road, Wimbledon, London, S.W.19, price 1s. 6d.

J. A. Rudderham

The Weather made Plain If we are to judge by everyday conversation, the British people, perhaps more than any other, have a tireless preoccupation with the weather—past, present and future. For farmers, however, the topic is of more than superficial interest; equally with his land, labour and capital, the weather is the vital fourth agent in his production, a factor which can make or mar any single operation to which he puts his hand. Thanks to science and the services of the Meterological Office, Weather, as well as Time, can be taken by the forelock, and day-to-day joms planned in the knowledge of what the whether is likely to be.

A useful guide to the circumstances which combine to build up the weather of the British Isles and a simple explanation of the changing phenomena from which the Met. officers make their forecasts is given in the Ministry of Agriculture's new, illustrated publication, *Weather and the Land* (price 3s, 3s. 1½d. by post). Special attention has been given to the importance of local variations, and it is particularly in this aspect that knowledge of meteorological cause and effect can be so valuable.

With this book at hand, references to barometric pressures, wind force and direction, temperature changes, warm and cold fronts, depressions and anticyclones, are no longer fearsome technicalities, and the village weather prophet, can implement his saws and sayings with more reliable information.

Milk and Meat British cattle, whether for beef, milk (or both), have been the foundation of stock improvement throughout the Commonwealth and in many other countries overseas. The numbers and value of live cattle exported from Britain today show that our cattle are still sought after as sires and dams of the finest herds in the world. A brief, up-to-date guide to the best-known breeds is essential to the cattle man or to those prospecting in the field of breeding, and the Ministry's new Bulletin No. 167, *Cattle of Britain*, fills the need for such a publication left by the absence of *British Breeds of Livestock* (Bulletin 86) since 1938.

Derived from a series of articles contributed to AGRICULTURE last year by the cattle breed societies, but completely revised up to the time of going to press, *Cattle of Britain* describes the characteristics and qualities of our stock, their reactions to a variety of climates and conditions and what, in economic terms, they can offer under a wide range of environmental conditions. It is well illustrated by representative sires and dams of each of the twenty-one breeds described in the bulletin.

Destroying Day-old Chicks Extensive investigations have recently been made at the Poultry Research Station of the Animal Health Trust at Houghton, Huntingdonshire, on a problem which has long troubled the commercial chick producer—how best to destroy surplus day-old chicks. The experiments, which were carried out in collaboration with the Chick Producers' Association and the R.S.P.C.A., point to petrol engine exhaust gas used in a specially designed, but simply constructed, chamber as being the most efficient and humane method for large-scale destruction. For use on a small scale (225-450 chicks), chloroform in a standard R.S.P.C.A. lethal chamber is recommended.

Methods involving carbon tetrachloride, carbon dioxide, butane gas and nitrogen were tried but are not recommended. Other practices, such as drowning or smothering, are condemned as highly undesirable.

Full details as to the construction of the exhaust gas chamber, and recommendations on size of engine needed, length of exposure, temperature and method of use are contained in a free leaflet (No. 3), obtainable from the General Secretary of the Trust at 14 Ashley Place, London, S.W.1.

The 1955 Poultry Show Last-minute shocks, usually arising from Fowl Pest restrictions, are now almost commonplace to the organizers of the Poultry Show: 1955 was no exception, and restrictions in three counties, including a standstill embargo on the whole of Lancashire, led to a good deal of reorganization among the entries. But despite all these early vicissitudes, the tenth National Poultry Show at London's Olympia on December 7-9 presented its usual efficient façade to the crowds who thronged the hall and gallery. Particularly pleasing to the organizers must have been the number of overseas visitors, who came from seventeen countries to see this display of British progress in poultry-keeping.

New attractions view this year with now firmly established features. The competitive table poultry section, with its attractive market packs, was especially popular, as also was the barbecue on the second day. Visitors were able not only to see but also to taste the quality of the produce! The manufacturers' stands, catering for everything the poultryman could possibly require—from incubators to market crates—were admirably staged, and the convention—now a regular feature of the show—was well supported. There were, in all, fourteen speakers during its five sessions, but undoubtedly the highlight was the first-day debate on the N.F.U.s proposed egg marketing scheme. Demonstrations included poultry packing and egg grading, and an exhibition of plucking, trussing and judging, presented by teams of Young Farmers, aroused a good deal of interest.

The Poultry Show is the newest of our national agricultural events, but it is already firmly fixed in the farming calendar. Since it was first modestly presented at Vincent Square in 1945, the poultry population of this country has increased by 50 per cent., and egg production has advanced to the gigantic figure of 800 million a year. It is only fitting, therefore, that the housewife, as well as the man in the business, should have this annual opportunity of seeing how the wheels of this thriving branch of British industry are oiled and turned.

IN BRIEF

High Velocity Hot Water Heating

The use of high velocity hot water for heating glasshouses has much to commend it. It should, however, be used through a system of small diameter pipes of 1-1¼ inches in diameter. The water is circulated by means of a pump control, and many glasshouses are not easy with this system. When the area of glass is large or when many separate houses require different temperatures, low pressure steam has advantages because of its ease of control, and its availability in every house naturally facilitates soil sterilization. These points were made by E. R. Hoare and L. G. Morris in a paper read to the November meeting of the Institution of British Agricultural Engineers. In the low pressure steam system the pipes are about 1¼ inches in diameter and are supplied with live steam at a gauge pressure of up to about 10 lb. per sq. inch. The steam gives up its latent heat to the pipes, and the condensed water, which is drained off at the far end of the system through steam traps, is returned to the boiler. The heating pipes are given a slight slope to help the flow of condensate. The steam supply is controlled by an on-off motorized valve operated by an air thermostat.

But the steam heating pipes should not be too long, and lengths greater than 75 feet can cause horizontal temperature gradients in the house. The system is economical because the cost of mains and heating pipes are low and separate houses can easily be controlled. It is a system which suits the larger grower.

An improvement on the steam heating method can be the use of a central steam boiler injecting the steam into a hot water system with small diameter pipes and high speed circulation. These steam injection systems have the advantage of the steam boiler, the cheap control system, and at the same time give an even temperature over the whole area of a large house. The National Institute of Agricultural Engineering is at present trying out various types of injection, especially to eliminate the noise and vibration commonly experienced with this method.

S S S

Bolting in Early-sown Sugar Beet

The provisional results of the 1955 N.I.A.B. observation trials on bolting in early-sown (March) sugar beet are reported in the current issue of the *British Sugar Beet Review*. They show that although the level of bolting varied greatly from centre to centre (from 5 per cent in Essex to over 30 per cent in the Spalding area), the pattern and general average was very similar to that in the previous year.

Seven of the strains in the trials gave similar results to 1954, but two—Johnson's E and Battle's E—bolted more than in the previous year, although still remaining amongst the better strains. British S.K.W.—a high-bolting strain—improved slightly. The best results were given by Bush N, a relatively new strain (8·1 per cent bolters), followed by Bush E (8·4 per cent).

Also in the trials were a few strains which, although grown occasionally in Britain, are not included in the contract list. Of these, the Cambridge Plant Breeding Institute's K.N.B. strain produced the lowest proportion of bolters of any strain in the trials.

These results refer, of course, only to bolting in plots sown early. They give no guide to yield, sugar percentage or top size. Such information is obtained from the main trials sown in April.

IN BRIEF

Food and the Future

Because of the rising cost of food, it seems probable that Britain and the other main food-importers will soon have to consider seriously whether they can produce food by unconventional means. If we were to assemble in one book all the hopeful articles on the subject and to take all conclusions at their face value, we might envisage a world in which the sea is farmed as thoroughly as the land, and not raided like a virgin forest; in which food is obtained from a high proportion of the world's half-million plants and not from a few hundred as at present; and in which edible micro-organisms are bred in shallow tanks, transparent tubes and on the surface of the sea.

John Gray, Progress

S S S

Poultry in India

A countrywide scheme for the co-ordinated development of poultry has been included in India's second Five-Year Plan. A network of about 300 development blocks will be established, in which chickens produced from accredited flocks will be housed and acclimatized for several months before the birds are distributed to poultry farms. India has about 73 million birds, or a tenth of the total world poultry population, but because of the lack of scientific methods of breeding and maintenance, their contribution to the national economy has been comparatively small.

S S S

Test your Seed Drill

Before drilling seed in the spring, it may be well worth while to check up on the setting of the drill. Makers' instructions can only be approximate because the seeding rate will vary with the size and condition of the seed. The so-called "calibration test" is quite simple and can be carried out in the shed. Jack up the driving wheel clear of the ground and put the drill in gear. Turn the wheel for the number of times which would be needed for the drill to cover, say, one-tenth of an acre. Then weigh the quantity of seed delivered and multiply the total by 10 to give the weight per acre.

You can find out the number of turns of the wheel corresponding to travel over one-tenth of an acre by the following formula:

$$\frac{484 \times 9}{\text{Sowing width of drill (in feet)} \times \text{circumference of wheel (in feet)}}$$

The sowing width of the drill is the distance between adjacent coulters multiplied by the number of coulters. For example, a 12-coulter drill with 7-inch spacing has a sowing width of 7 feet.

S S S

Pigs and Per Ardua . . .

Top price lean porkers fed on camp swill are being produced by the Royal Air Force at Pembury, Carmarthenshire. The station took over a derelict farmstead a few yards from the airfield and turned an old barn into a Danish-type fattening house. This will hold up to 130 pigs, and at present nine or ten are sold locally every week at about 115 lb. live weight. Diet consists of 75 per cent swill, 20 per cent dredge corn and 5 per cent purchased concentrates. There is no *ad lib.* feeding for these porkers; feeding is carefully controlled to avoid over-fatness, and they reach market weight in about 17 weeks. The "herdsmen" are all volunteers in their off-duty hours.

Pig Farming, December

Holland's Delta Plan

Out of the tragedy of the 1953 floods has come the investigating Commission's Delta Plan, which provides for the building of three new main dykes, the strengthening of others and the undertaking of a number of secondary works. The new dykes will cover some 20-30 km., leaving the old dykes to form a valuable second line of defence.

Mr. A. G. Maris, Director-General of the Netherlands Department of Roads and Waterways, describes this project in the autumn issue of *Progress*. "Ultimately," he says, "the complete security of Holland against the invading sea will rest upon an unbroken coastline, a plan in which the Wadden Islands will be connected by dykes of some kind, but this is looking far into the future, for the Wadden Sea scheme is still in the earliest stages of planning." Except in the immediate locality of the Westerschelde and the Rotterdamsche Waterweg, which must, of course, be kept unhampered for shipping entering and leaving Antwerp and Rotterdam, the Delta scheme will prevent the inland penetration of gale-swept high tides, even though the water level rises much higher than it did in February 1953.

It is a paradox that Holland, which seems to have a superabundance of water, also has the problem of a shortage of fresh water. The Delta scheme will also provide, incidentally, for the storage of fresh water in the Zeeland estuaries (the Zeeuwse Meer), so insuring against time of scarcity.

Proctor Barley

The malting quality of Proctor barley was the subject of a question to the Minister in the House on November 24. Mr. Heathcoat Amory said that this variety first became available in commercial quantities in 1955. The Brewers' Society has said that small-scale malting trials with Proctor barley harvested in 1953 and 1954 and commercial maltings made so far this season have been satisfactory. This barley has out-yielded the older Kenia and Archer types in trials by 12 to 15 per cent, and there is some evidence that these results are being borne out in farm practice.

Now Two Bob a Tail

Over 750,000 grey squirrels have been killed during the past two years. In the hope that the pest can now virtually be exterminated, the Forestry Commission announced in early December that two shillings, instead of one, will be paid for each tail presented to pest control officers in 1956. The idea is to prevent any recovery in the present greatly reduced population. At an average annual rate of increase of four young to each female, and a likely good season for beech mast next autumn which will ensure the squirrels' food supplies, the ground so far won could easily be lost.

Bovine Tuberculosis Eradication

About one million additional cattle have become attested during the past year, bringing the total to some 60 per cent of all cattle in Britain.

BOOK REVIEWS

When Badgers Wake. EILEEN SOPER. Routledge and Kegan Paul. 20*s*.

The publishers of this book claim that " as a record of behaviour of one colony of badgers over a consecutive period of four years it is unique ". I don't doubt that they are right. It is certainly an outstandingly good book. As an example of accurate and sustained observation it is a remarkable achievement, and those of us who know something of badger watching will appreciate to the full the qualities of patience, enthusiasm and endurance which must have gone to the making of it. Clearly, too, the author has been inspired by a love of her subject, and the reader will quickly understand why she, like so many others, has succumbed to the fascination of watching Britain's most likeable wild mammal.

Miss Soper makes no attempt to hide her concern at the senseless persecution which, alas, is still the lot of the badger, and is rightly scornful of the attitude of mind exemplified by *Punch's* famous workman—" 'Ere's a queer looking bloke; let's 'eave a brick at 'im ". The tonnage of unwarranted bricks heaved at the luckless badger over the centuries by the prejudiced and the ignorant is harrowing for any naturalist to contemplate.

The profuse sketches, by Miss Soper herself, are wholly admirable. Light but effective, they catch to the life the various postures, expressions and movements of the models. Those illustrating the reactions of inquisitive cubs will bring a reminiscent smile to the face of many a badger watcher. How exactly right they are!

Any criticism of the book would be niggling, and the only question in my mind is whether it might not have been better to omit the " digressions " covering dormice, stoats and birds. Excellent little character studies though they are, they might perhaps have been kept for some other book. The badgers themselves are surely full measure for this one.

By any standard this four-year badger saga is a first-class story. Moreover, it is hard fact, pleasingly written but free from sentimentality and fantastic statements. Any nature-lover who wants to know what badgers are really like, how they live, work and play, and how they react to the world about them, will find no better account anywhere.

F.H.L.

Farm Organisation in Dorset. (University of Bristol, Department of Economics Report No. 85). J. A. LANGLEY, H. W. B. LUXTON and S. T. MORRIS. 4*s*.

An up-to-date appreciation of the agricultural position of north Dorset is provided by this report, which classifies farms by main enterprises and then statistically analyses them according to size and type. A wealth of information is included in the concise text, and no less than 49 tables deal with cropping, livestock, labour and machinery statistics.

With 73.3 per cent of the land in permanent grass, and 87.3 per cent of it devoted to dairying, one of the problems inherent to an area of this kind is that of developing to the full the basic resources of the land in the production of milk. Technically, much is possible by judicious fertilizer usage, some reseeding, strip grazing, silage-making and herbicidal weed control. The cheapening of the heavy and continuing commitments of draining, ditching and hedging, plus the provision of low cost and labour-saving buildings for the winter housing of stock, would all help towards higher and cheaper production. Stages II and III of this research study will help to show to what extent farm businesses in this area can economically exploit these technical possibilities, for they will entail detailed sudy of dairy farms in the area, and the application of budgetary analysis and farm planning techniques.

It is fair comment to say that this first report takes no account of the most important single factor in any business—the human one. But this is a " variable " which does not lend itself to factual appreciation. Nevertheless, in the light of the comprehensive information given, the thinking farmer and the adviser will most certainly be able to assess more accurately the managerial potentialities of farm businesses in this part of Wessex.

To all interested in the farming of north Dorset, *Farm Organisation in Dorset* is a unique and valuable reference work. It has, too, a wider appeal to all concerned with farm management and organization, since it is a good example of an additional and effective tool for the job. The report demonstrates not only the comprehensive and group approach, but also the value of basic research.

R.G.

Rothamsted Experimental Station Report, 1954. 7*s.* 6*d.*

In this well-written report a general summary of the work at the station is followed by a more detailed description of research on the many problems connected with maintaining good soil conditions and crop growth. Constant reference is made throughout its pages to the practical implications of experimental results, of which the following are typical.

Whilst irrigation of early potatoes and grass has been shown at Woburn to be very much worth while, irrigation in the wet summer of 1954 reduced yields slightly. Side-placement of fertilizer is shown markedly to benefit, in earliness and yield, a number of horticultural crops grown as part of an arable rotation of farm crops; the increased returns may even justify buying special placement drills for such high value crops. Responses to side-placement are, however, likely to be less on heavily worked and manured market-garden soils.

Early sowing and the establishment of a spring cereal crop may usefully reduce wild oats for which, as for other weeds, crop competition plays an important part in controlling infestation. Work on the extraction of protein from grass indicates that the use of pressure to remove much of the water in grass might reduce the cost of commercial grass drying. A study of the enzymes in the bracken plant has given a lead to the possible formulation of a bracken-killing agent.

Further experiments on the control of virus diseases in root crops by the use of insecticide sprays continue to show the benefits of such treatments.

The report also contains special reviews on clay minerals and on the uptake of nutrients from leaf sprays by agricultural crops. The latter review comments on the limited usefulness of leaf spray applications of plant nutrient in farm practice.

A.J.L.L.

Engineering in Agriculture. P. H. SOUTHWELL. Temple Press. 30*s.*

As Mr. Southwell points out in his introductory chapter, mechanization has been extensively adapted to agricultural needs in a relatively short time, and the thoughts of most users have been concerned with how best to use the equipment available and how to maintain it. There can be no doubt that these decisions, together with the choice of the right machine for a particular set of conditions, can best be made by the man who has the basic principles of machine design and operation at his fingertips. Furthermore, under the variety of conditions encountered in agriculture, and particularly in overseas agriculture, the user may wish to make simple modifications or modify existing structures. Here again it is imperative to understand fully the engineering aspects involved.

The information contained in this book amply satisfies these requirements. Essential basic data are provided in the early chapters, and these are followed by detail, usually found only in text-books, on such subjects as Mechanics and Mechanisms, Structures, Strength and Properties of Materials, Hydraulics, Electricity and Surveying.

The subject-matter is always treated simply, so that the least technical of readers can follow the main body of the text, and the book is very fully illustrated by sketches and line drawings. The application of the engineering principles described to the practice of agriculture is emphasized throughout, and a large number of practical examples are quoted.

The book should be particularly useful to farmers overseas who wish to keep their library of reference books to the minimum. A comprehensive list of tables and definitions in the appendix, including, for example, a list of the drawbar pull requirements for various implements in a medium soil, is especially valuable.

T.C.D.M.

Land, Water and Food. HERBERT ADDISON. Chapman and Hall. 18*s.*

There have been a number of contributions to the subject of reclamation in recent years; but in *Land, Water and Food* we have a new approach, in which the author stresses the fundamental problem confronting the reclamation of all land—namely, water. Whether it is gaining land from swamp, harnessing water by damming, or conveying water overland for orderly dispersal by irrigation, the problem of arresting a surplus or of providing extra water to supply plant needs is basic to the success of recovering land to supply the ever-increasing needs of the world's growing population.

The author does not content himself with the description of the problems of a single project; he casts his net wide and lays before the reader a vast panorama of works which are not only a credit to man's ingenuity, but a living memorial to the success of engineers, designers and agriculturists of many nations. In this book you may follow the contributions which have been made throughout the world to secure better living standards—as witnessed by the Dutch determination in the enclosure of the Zuyder Zee, by Greek endeavours at Lake Copais, by the harnessing of the waters of the Nile and the triumph of Sudan cotton. The projects are described with the detail only to be expected from an enthusiast and authority on his subject, yet the author also finds time to stop and mention the one-time splendour of Babylon. (I was a little disappointed that more was not said of this ancient history, particularly relating to remains of former irrigation and drainage works.)

As regards Britain, the author considers the possibilities of larger irrigation schemes and dwells upon the sufficiency of water and possibility of control over our internal river flooding. The book is all about water and, in the author's own words, is "no more than a contribution to a current discussion". The comment is modest, but nevertheless true of a very complex subject.

P.J.O.T.

Handbook of Food and Agriculture. Edited by FRED C. BLANCK. Chapman and Hall. £5.

This book has the advantage of the modern style of comprehensive work in which each subject is competently dealt with by an acknowledged expert; it has also the disadvantage of discontinuity in comparison with the handbook or text-book of fifty years or more ago in which one man attempted to survey the present state of knowledge of a subject.

The soundness and authority of the contents of this book may be taken for granted when chapters are written by such world-known authors as H. R. Kraybill (Animal Products), Hans Lineweaver and A. A. Klose (Poultry Products), and Harry E. Gorseline (Food Spoilage and Deterioration). It is a book which, once seen, will not remain far away from any worker in food science or technology. However, its scope is limited and a little surprising. In spite of the title, it deals essentially with food technology and nutrition. Out of twenty-six articles there are only six which can be regarded as essentially agricultural. These are: Soils; Soil Fertility; Soil Microbiology; Fertilizers; Insecticides, Fungicides and Herbicides; and Growth Regulants. The preface frankly acknowledges that the scope of agriculture and food is so wide that articles on all phases could not be included, so discussions were omitted on horticulture, agricultural engineering, plant pathology, animal breeding, climatology, and many others.

Even so, there are over 1,000 pages filled with up-to-date information not otherwise easily available. The appendices will be of considerable interest to British readers interested in the progress of nutrition, hygiene and food legislation in the United States of America. They provide sections on the food laws of the U.S.A., details of the National Research Council's dietary allowances, food consumption tables and nutrients available, and a statement on U.S. policy in relation to the addition of nutrients to foods (restoration and fortification). It is useful to find here also details on the terms of reference and functions of two international agencies—the Food and Agriculture Organization and the World Health Organization.

Inevitably in a book of this nature, there is some overlapping and duplication. For example, different chapters by different authors deal with storage of agricultural raw products, food preservation, and food spoilage and deterioration. But in each of these details of the cold storage of eggs recur. As in the commodity chapters, however, the material is presented in each instance from a slightly different viewpoint. This in itself is valuable.

In the United Kingdom, agricultural teaching, research and the application of research are well established. Research and teaching in relation to food technology and nutrition is of recent origin and small in extent. The *Handbook of Food and Agriculture* should help the agricultural research worker and adviser who wishes to extend his knowledge in connection with the storage, transport and processing of agricultural produce. It will, however, be most useful as an aid to the development of research and of teaching in food science, both through its contents and the leads which it provides to the literature, even though the latter is limited mainly to U.S.A. and United Kingdom sources.

H.R.B.

Report on Farming 1954-55. Farm Economics Branch, School of Agriculture, Cambridge. 3*s.* 6*d.*

This report is the latest in the series of surveys of the economic position of Eastern Counties farming which the Cambridge School of Agriculture carries out every year. Based on financial records from over 300 farms, it shows that the unfavourable weather of 1954 had a much smaller influence on farming profits in eastern England than in the country as a whole, and confirms the view that a wet summer rarely depresses profits in the Eastern Counties. But in analysing the year's working, the report does provide some revealing figures on the value of subsidies and grants paid direct to the farmer. Some farming districts are obviously much more dependent on them than others.

A valuable section of the survey reviews the changes that have taken place over the last twenty years in the sources of revenue and the profits earned by a group of farms. It shows that in the ten years since the war there has been a further intensification of production, with both the arable acreage and livestock numbers continuing to rise.

The results of two minor surveys amongst market garden and specialist poultry farms show that profits from vegetable production fluctuate very widely as the result of price variations, and that the chief causes of low profits with poultry are low yields, excessive use of feed and too small units.

Also included is a section on the analysis of farm accounts and the use of efficiency standards in enabling the farmer to compare his own farming results with those of other farms of similar type in the same area.

L.W.O.

Farmer and Stock-Breeder Year Book and Desk Diary, 1956. Farmer and Stock-Breeder. 12*s.* 6*d.*

We have come to expect a high standard in the production and usefulness of the Farmer and Stock-Breeder's Year Book, and one might have thought it virtually incapable of improvement. Nevertheless they have done it, by adding a substantial section for diary entries (3-4 days to a page), enlarging the size from the old $8\frac{1}{2} \times 5\frac{1}{2}$ inches to $11\frac{1}{2} \times 8\frac{1}{2}$ inches and binding with a ring spine which ensures that the book opens and stays flat on the desk. It was a happy thought, too, to annotate each page of the diary with items of day-to-day farming memorabilia.

There are all the usual references (efficiently indexed and distinguished) to all the organizations, official, commercial and academic, which the ordinary farmer is likely to want to know about. There are items of information on a diversity of farming interests—from agricultural returns to weed-killers, from Aberystwyth strains to yields of the main arable crops.

The 64-page pictorial section is even more impressive than usual this year, making a miniature livestock "Debrett", which stockmen everywhere will ponder with pleasure and savour with satisfaction.

Quite frankly, I cannot imagine that any farmer knowing about this book would be content to start the new year without it.

S.R.O'H.

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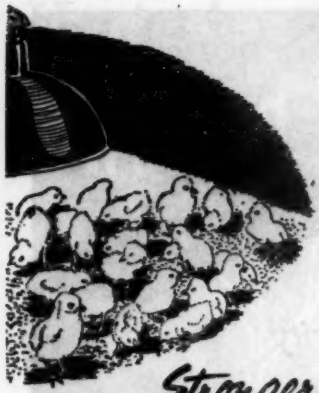

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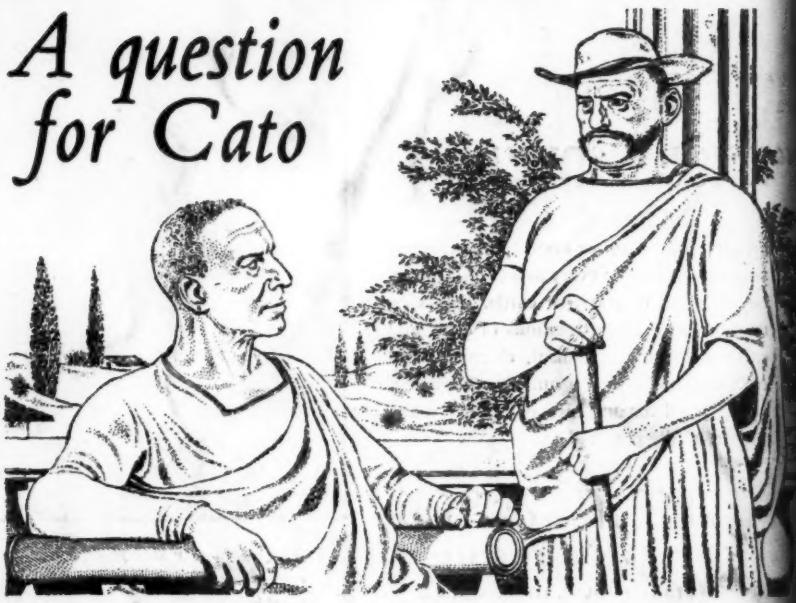
A question for Cato



MARCUS PORCIUS PRISCUS CATO, known in history as 'the Censor', was one the ablest Roman statesmen of his time (234-149 B.C.). He began life as a farm and his book *De Re Rustica* ranks among the earliest treatises on agriculture.

The historian Pliny records that Cato was once asked what was the best sou of profit on the farm. He replied:

'Good pasture'.

'*And what next?*'

'Fairly good pasture'.

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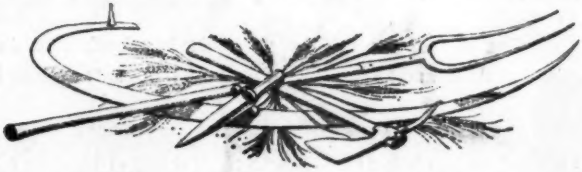

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